E-Series Ethernet Radio User Manual

ER45e Remote Data Radio
EB45e Base Station
EH45e Hot Standby Base Station
Firmware version 5.5.0

Schneider Electric

Contents

Part A – Preface

Warranty

All equipment supplied by Trio Datacom Pty Ltd (As of 1 January 2009) is covered by warranty for faulty workmanship and parts for a period of three (3) years from the date of delivery to the customer. During the warranty period Trio Datacom Pty Ltd shall, at its option, repair or replace faulty parts or equipment provided the fault has not been caused by misuse, accident, deliberate damage, abnormal atmosphere, liquid immersion or lightning discharge; or where attempts have been made by unauthorised persons to repair or modify the equipment.

The warranty does not cover modifications to software. All equipment for repair under warranty must be returned freight paid to Trio Datacom Pty Ltd or to such other place as Trio Datacom Pty Ltd shall nominate. Following repair or replacement the equipment shall be returned to the customer freight forward. If it is not possible due to the nature of the equipment for it to be returned to Trio Datacom Pty Ltd, then such expenses as may be incurred by Trio Datacom Pty Ltd in servicing the equipment in situ shall be chargeable to the customer.

When equipment for repair does not qualify for repair or replacement under warranty, repairs shall be performed at the prevailing costs for parts and labour. Under no circumstances shall Trio Datacom Pty Ltd's liability extend beyond the above nor shall Trio Datacom Pty Ltd, its principals, servants or agents be liable for the consequential damages caused by the failure or malfunction of any equipment.

Related Products

ER45e Remote Data Radio
EB45e Base/Repeater Station
EH45e Hot Standby Base Station

Other Related Documentation and Products

ER45e Quick Start Guide
TView+ Management Suite
Multiplexer Stream Router (MSR)

Revision History

Issue 10-12 (October 2012) - Added details for new features available in firmware 5.5.0.

Important Notice

This manual covers the operation of the E Series Ethernet Radios. Specifications described are typical only and are subject to normal manufacturing and service tolerances.

Trio Datacom Pty Ltd reserves the right to modify the equipment, its specification or this manual without prior notice, in the interest of improving performance, reliability or servicing. At the time of publication all data is correct for the operation of the equipment at the voltage and/or temperature referred to. Performance data indicates typical values related to the particular product.

Compliance Information

⚠️ **Warning – RF Exposure**

The radio equipment described in this user manual emits low level radio frequency energy. The concentrated energy may pose a health hazard depending on the type of antenna used.

To satisfy EU and FCC requirements a minimum separation distance should be maintained between the antenna of this device and persons during operation as per the table below.

Range of Antenna gains (dBd)	Minimum Separation from Antenna (Meters)
0 to 4	0.91
4 to 8	1.44
8 to 12	2.28
12 to 16	3.61

FCC Notice (Hot Standby Controller Only)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction, equipment may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Re-orient to relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different to that which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for assistance.

IC Notice (Hot Standby Controller Only)

This Class B digital apparatus complies with Canadian ICES-003. Cet appariel numerique de la class B est conforme a la norme NBM-003 du Canada.

Safety

Warning: Where an ER45e is to be operated between 45°C and 70°C ambient, it must be installed in a restricted access location.

Warning: Where an EB45e is to be operated between 50ºC and 70ºC, it must be installed in a restricted access location.

Site Earthing

Ensure that the chassis mounting plate, power supply (-) earth, RTU terminal device, and lightning arrester, are all securely connected to the earth in the building installation or a common ground point to which an earth stake is attached.

R&TTE Notice (Europe)
Applies to models Ex45e-xxExx-xxx

In order to comply with the R&TTE (Radio & Telecommunications Terminal Equipment) directive 1999/5/EC Article 3 (Low Voltage Directive 73/23/EEC), all radio modem installations must include an external in-line lightning arrestor or equivalent device that complies with the following specifications:

- DC Blocking Capability - 1.5kV impulse (Rise Time 10mS, Fall Time 700mS) (Repetition 10 Times) or 1.0kV rms 50Hz sine wave for 1 minute.

Trio Datacom declares that the Ethernet E-Series radio modem range are in compliance with the essential requirements and other relevant provisions of the Directive 1999/5/EC. Therefore Trio Datacom Ethernet E-Series equipment is labelled with the following CE-marking.

$$ C \in 0889 \, ① $$
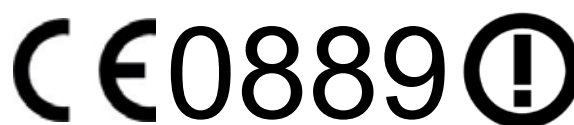
Co-Locating the ER45e remote (Europe)

The ER45E is a remote radio and should not be co-located with other transmitting equipment.

Safety Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to a potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ WARNING

WARNING indicates a poentialy hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially haradous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** equipment damage.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

WEEE Notice (Europe)

This symbol on the product or its packaging indicates that this product must not be disposed of with other waste. Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact the dealer from whom you originally purchased the product.

Dieses Symbol auf dem Produkt oder seinem Verpacken zeigt an, daß dieses Produkt nicht mit anderer Vergeudung entledigt werden darf. Stattdessen ist es Ihre Verantwortlichkeit, sich Ihre überschüssige Ausrüstung zu entledigen, indem es rüber sie zu einem gekennzeichneten Ansammlungspunkt für die Abfallverwertung elektrische und elektronische Ausrüstung übergibt. Die unterschiedliche Ansammlung und die Wiederverwertung Ihrer überschüssigen Ausrüstung zu der Zeit der Beseitigung helfen, Naturresourcen zu konservieren und sicherzugehen, daß es in gewissem Sinne aufbereitet wird, daß menschliche Gesundheit und das Klima schützt. Zu mehr Information ungefähr, wo Sie weg von Ihrer überschüssigen Ausrüstung für die Wiederverwertung fallen können, treten Sie bitte mit dem Händler in Verbindung, von dem Sie ursprünglich das Produkt kauften.

Part B – Ethernet E Series Overview

Definition of Ethernet E Series Radio

The E Series Ethernet radios are a range of wireless modems designed for the transmission of data/ Ethernet communications for SCADA, telemetry and any other information and control applications that utilise ASCII messaging techniques. The E Series Ethernet radios use advanced "digital" modulation and signal processing techniques to achieve exceptionally high data throughput efficiency using traditional licensed narrow band radio channels.

These products are available in many frequency band and regulatory formats, to suit spectrum bandplans, in various continental regions. The range is designed for both fixed point to point (PTP), and multiple address (MAS) or point to multipoint (PTMP) systems.

Ethernet E Series Product Range

The E Series Ethernet product range consists of the basic half duplex "Remote" radio modem, an extended feature full duplex Remote radio modem, and ruggedised Base Station variants, including an optional Hot Standby controller to control two base station units in a redundant configuration.

ER45e Remote Radio

EB45e Base / Repeater Station

EH45e Hot Standby Base Station

Features

Ethernet

- Maximum narrowband channel utilization with

- Smart peer to peer repeating

- Ethernet filtering

- Data Compression

- Flexible system configuration using IP Layer 3 transport & routing

- Advanced commissioning tools and remote diagnostics including SNMP.

- RS-232 serial support via embedded terminal server (UDP/TCP).

Security

- Secure operation with 128-bit AES encryption**

- Password protected remote configuration including SNMP

Radio and Modem

- Up to 19,200 bps over-air data rates in 12.5 & 25kHz channels

- ChannelShare™ unique integrated C/DSMA collision avoidance technology permits simultaneous polling and spontaneous alarm reporting operation in the same system.

- Improved scan times with fast data turnaround

- Simplex, Half Duplex and Full Duplex (Full Duplex with ERFD450 option)

- Reliable operation from -30° to + 70° C

- High performance transmitter with overtemperature and high VSWR protection

- DIN Rail mounting kit option

Connectivity

- Independent Ethernet & Serial ports

- Compatible with most SCADA protocols: Ethernet/IP & Serial (MODBUS / DNP-3 / IEC etc)

- Ethernet Port is 10/100Mbps (auto MDIX sensing) IEEE 802.3

- Selectable 300 - 38.4 kbps asynchronous RS-232 interface

- RS-232 serial support via embedded terminal server (UDP/TCP).

- Separate on-line system port avoids the need to interrupt user data for configuration access

Network Management and Remote Diagnostics

- Remote fully transparent Network Management and Diagnostics

- Network wide operation from any radio modem

- Full SCADA style features such as database, trending and networking

- Over-the-air modem reconfiguration

- Full graphical presentation (HMI)

- Note: Some features require TView+ software

- Radio is SNMP V1/V2c RFC-1213 compliant and supports Trio E-Series radio diagnostics parameters (including alarm generation via traps).

Product Data Sheet Trio ER45e | ER450 Model Code

	TBURER45x-aabbbcde represents the part number matrix
Model	**Trio Radio ER450 & ER45e**
TBURE	**E-Series**
Code	**Select: Unit Type**
R	**Remote Station with full enclosure**
Code	**Select: Generic Frequency Band**
45	**370 to 518 MHz**
Code	**Select: Data Ports**
O	**Two serial ports**
E	**One Ethernet & one serial port**
Code	**Frequency (400MHz bands) – Frequencies to be specified at time of order**
46	**370 to 388 MHz (Tx & Rx)**
47	**380 to 396 MHz (Tx & Rx)**
48	**395 to 406 MHz (Tx & Rx)**
50	**403 to 417 MHz (Tx & Rx)**
63	**406 to 421 MHz (Tx & Rx)**
64	**415 to 430 MHz (Tx & Rx)**
56	**418 to 435 MHz (Tx & Rx)**
57	**428 to 444 MHz (Tx & Rx)**
55	**436 to 450 MHz (Tx & Rx)**
51	**450 to 465 MHz (Tx & Rx)**
65	**455 to 470 MHz (Tx & Rx)**
52	**465 to 480 MHz (Tx & Rx)**
53	**480 to 494 MHz (Tx & Rx)**
60	**490 to 500 MHz (Tx & Rx)**
54	**505 to 518 MHz (Tx & Rx)**
A6	**370 to 400 MHz (Tx & Rx)**
B3	**395 to 426 MHz (Tx & Rx)**
B4	**413 to 447 MHz (Tx & Rx)**
B5	**433 to 450 MHz (Tx & Rx)**
C1	**436 to 467 MHz (Tx & Rx)**
C2	**450 to 487 MHz (Tx & Rx)**
C3	**473 to 518 MHz (Tx & Rx)**
Code	**Select: RF Channel Data Rate & Bandwidth (Internal Modem)**
F01	**FCC (IC) 9600 / 19k2bps, 12.5kHz – provides M-Series 003 compatability**
F02	**FCC (IC) 19k2bps, 25kHz – Not for sale in North America**
E01	**ETSI 9600bps, 12.5kHz – provides M-Series 004 compatability**
A01	**ACMA 4800 / 9600bps, 12.5kHz – provides M-Series 001/002 compatability**
A02	**ACMA 9600 / 19K2bps, 25kHz**
Code	**Select: Encryption (subject to country of use)**
D	**No Encryption**
X	**No Encryption, full duplex option - requires external duplexer**
E	**Encryption***
Y	**Encryption*, full duplex option - requires external duplexer**
Code	**Select: Hazardous Area Approvals**
H	**Hazardous Environment Class 1 Div 2 Groups A, B, C & D**
Code	**Hot Standby Configuration**
O	**Not used**

Example: TBURER450-A6F01EH0 specifies: Trio ER450 remote station, two serial ports, frequencies to be specified at time of order, FCC (IC) 12.5kHz, Encryption, Class 1 Div 2. Export restrictions may apply. Contact your local representative for more details.

* Export restrictions may apply. Contact your local representative for more details.

Communications Standard:
FCC- Federal Communications Commission (USA)
IC- Industry Canada
ETSI - European Telecommunication Standards Institute
ACMA - Australian Communications and Media Authoroity

Product Data Sheet Trio EB450 & EB45e Model Code

	EB45x-aabbb-cde represents the part number matrix
Model	**Trio Radio EB450 & EB45e**
TBURE	**E-Series**
Code	**Select: Unit Type**
B	**Base / Repeater Station**
Code	**Select: Generic Frequency Band**
45	**380 to 518 MHz**
Code	**Select: Data Ports**
0	**Two serial ports**
E	**One Ethernet & one serial port**
Code	**Frequency (400MHz bands) – Frequencies to be specified at time of order**
47	**380 to 396 MHz (Tx & Rx)**
48	**395 to 406 MHz (Tx & Rx)**
50	**403 to 417 MHz (Tx & Rx)**
63	**406 to 421 MHz (Tx & Rx)**
64	**415 to 430 MHz (Tx & Rx)**
56	**418 to 435 MHz (Tx & Rx)**
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A6	**370 to 400 MHz (Tx & Rx)**
B3	**395 to 426 MHz (Tx & Rx)**
B4	**413 to 447 MHz (Tx & Rx)**
B5	**433 to 450 MHz (Tx & Rx)**
C1	**436 to 467 MHz (Tx & Rx)**
C2	**450 to 487 MHz (Tx & Rx)**
C3	**473 to 518 MHz (Tx & Rx)**
Code	**Select: RF Channel Data Rate & Bandwidth (Internal Modem)**
F01	**FCC (IC) 9600 / 19k2bps, 12.5kHz – provides M-Series 003 compatability**
F02	**FCC (IC) 19k2bps, 25kHz – Not for sale in North America**
E01	**ETSI 9600bps, 12.5kHz – provides M-Series 004 compatability**
A01	**ACMA 4800 / 9600bps, 12.5kHz – provides M-Series 001/002 compatability**
A02	**ACMA 9600 / 19K2bps, 25kHz**
Code	**Select: Diagnostics & Encryption**
D	**Diagnostics Only (No Encryption)**
E	**Diagnostics & Encryption***
Code	**Select: Options**
0	**Separate Tx & Rx Antenna Ports**
1	**Configured for internal band reject duplexer. Duplexer not included. Contact local sales office for further details.**
A	**20W RF Power Output****
Code	**Hot Standby Configuration**
0	**Not used**

Example: TBURER450-A6F01EH0 specifies: Trio ER450 remote station, two serial ports, frequencies to be specified at time of order, FCC (IC) 12.5kHz, Encryption, Class 1 Div 2. Export restrictions may apply. Contact your local representative for more details.

* Export restrictions may apply. Contact your local representative for more details.

** Local regulatory conditions may prevent the use of 20W in some countries.

Communications Standard:
FCC- Federal Communications Commission (USA)
IC- Industry Canada
ETSI - European Telecommunication Standards Institute
ACMA - Australian Communications and Media Authoroity

Product Data Sheet Trio EH450 & EH45e Model Code

	EH45x-aabbb-cde represents the part number matrix
Model	**Trio Radio EH450 & EH45e**
TBURE	E-Series
Code	**Select: Unit Type**
H	Hot Standby Base / Repeater
Code	**Select: Generic Frequency Band**
45	380 to 518 MHz
Code	**Select: Data Ports**
O	Two serial ports
E	One Ethernet & one serial port
Code	**Frequency (400MHz bands) – Frequencies to be specified at time of order**
47	380 to 396 MHz (Tx & Rx)
48	395 to 406 MHz (Tx & Rx)
50	403 to 417 MHz (Tx & Rx)
63	406 to 421 MHz (Tx & Rx)
64	415 to 430 MHz (Tx & Rx)
56	418 to 435 MHz (Tx & Rx)
57	428 to 444 MHz (Tx & Rx)
55	436 to 450 MHz (Tx & Rx)
51	450 to 465 MHz (Tx & Rx)
65	455 to 470 MHz (Tx & Rx)
52	465 to 480 MHz (Tx & Rx)
53	480 to 494 MHz (Tx & Rx)
60	490 to 500 MHz (Tx & Rx)
54	505 to 518 MHz (Tx & Rx)
A6	370 to 400 MHz (Tx & Rx)
B3	395 to 426 MHz (Tx & Rx)
B4	413 to 447 MHz (Tx & Rx)
B5	433 to 450 MHz (Tx & Rx)
C1	436 to 467 MHz (Tx & Rx)
C2	450 to 487 MHz (Tx & Rx)
C3	473 to 518 MHz (Tx & Rx)
Code	**Select: RF Channel Data Rate & Bandwidth (Internal Modem)**
F01	FCC (IC) 9600 / 19k2bps, 12.5kHz – provides M-Series compatability
F02	FCC (IC) 19k2bps, 25kHz – Not for sale in North America
E01	ETSI 9600bps, 12.5kHz
A01	ACMA 4800 / 9600bps, 12.5kHz - provides M-Series compatability
A02	ACMA 9600 / 19k2bps, 25kHz
Code	**Select: Diagnostics & Encryption**
D	Diagnostics Only (No Encryption)
E	Diagnostics & Encryption*
Code	**Select: Options**
O	Separate Tx & Rx Antenna Ports
1	Internal base station band reject duplexers. No RF switching via Hot Standby Controller. Ref to Hot Standby configuration diagram. #
A	20W RF Power Output**
Code	**Hot Standby Configuration**
A	Separate Tx & Rx Antenna ports with RF switching via Hot Standby Controller
B	Dual Redundant External Duplexers (not included) with no RF switching via Hot Standby Controller
C	Internal hot standby controller band reject duplexers. No RF switching via Hot Standby Controller. Ref to Hot Standby configuration diagram. #
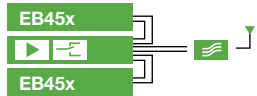
Example: TBUREH450-C2F01E0A specifies: Trio EH450 hotstandby repeater, two serial ports, frequencies to be specified at time of order, FCC (IC) 9600/19K2bps, 12.5kHz, Diagnostics & Encryption, seperate Rx & Tx ports.

*Export restrictions may apply. Contact your local sales office for details.

**Local regulatory conditions may prevent the use of 20W in some countries.

#Note - Suitable duplex reference number is TBURDUPLXBR450COD. The supply of duplexers is not included in the reference number or in the price for any reference number - the reference number only indicates that equipment is configured for a particular duplexer arrangement. If TBURDUPLXBR450COD duplexer is required to be factory fitted then this must be clearly specified at time of order. Contact local sales office for further details.

EH45x Hot Standby Controller Configurations

EHHSC Hot Standby Controller Version

External Duplexer
TBUREH45x-xxxxxxx<u>A</u>
• 2 x TBUREB45-xxxxxxx0
• 1 x TBUREHHSC-00<u>A</u>

A

TBUREH45x-xxxxxxx<u>B</u>
• 2 x TBUREB45x-xxxxxxx0
• 1 x TBUREHHSC-00<u>B</u>

B

Internal Duplexer (Band Reject only)
TBUREH45x-xxxxxx0<u>C</u>
• 2 x TBUREB45x-xxxxxx00
• 1 x TBUREHHSC-00<u>C</u>
– duplexer insider EHHSC*

C

TBUREH45x-xxxxxx1<u>B</u>
• 2 x TBUREB45x-xxxxxx10
– duplexer insider EB45x*
• 1 x TBUREHHSC-00<u>B</u>
– standard option B as above

B

LNA (Low Noise Receiver Amplifier / Splitter)   RELAY (Coaxial Transmitter Switch)   DUPLEXER

Hot Standby Controller options

	Description	Duplexer	Antenna Type
A	LNA & RF Relay Fitted	Not Fitted	Separate Tx & Rx Ant
B	No RF connections	Not Fitted	No Antenna Connection
C	LNA & RF Relay Fitted	Band Reject	Single Antenna (Tx/Rx)

#Note – Suitable duplexer reference number is TBURDUPLXBR450COD. The supply of duplexers is not included in the reference number or in the price for any reference number – the reference number only indicates that equipment is configured for a particular duplexer arrangement. If TBURDUPLXBR450COD duplexer is required to be factory fitted then this must be clearly specified at time of order.

Contact local sales office for further details.

Part C – Network Types

Introduction

Fundamental to understanding the use of E Series Ethernet Radios in your system is the need for a basic understanding of the different types of radio network topologies (known as NETWORK TYPES) and the function of each radio within them (known as RADIO MODES).

The following table provides a brief overview of each:

Network Types:

   Point to Point (PTP): One Access Point radio is configured to communicate with a REMOTE radio in PTP mode.
   Point to Multipoint (PTMP): One Access Point radio is configured to communicate with multiple REMOTE radio(s) a PTMP network
   Multipoint to Multi point simplex frequency(MPMP): All units configured as Access Point with Carrier Detect Collision Avoidance remote set in all.

Radio Modes:

   Access Point: Defines the Access Point radio in a network. The function of the Access Point is to manage remotes or access points.
   Remote: A remote radio in the network. The function of a remote is to communicate with the Access Point either directly or if it is the repeater, then through it.

Each type of network is described in the following diagrams.

Point-to-Point Networks (PTP)

A Point to Point (PTP) network has one Access Point and one remote radio. Normally full duplex radios are installed, providing full data throughput in each direction. Alternatively, half-duplex radios can also be implemented although collision avoidance must be enabled.

Full Duplex radios have the advantage that they simulate a cable connection with respect to the connected device. Even if one device transmits continuously it will not block the other device from sending data. This is useful for applications that expect full duplex communications or that are not designated to be radio modem friendly.
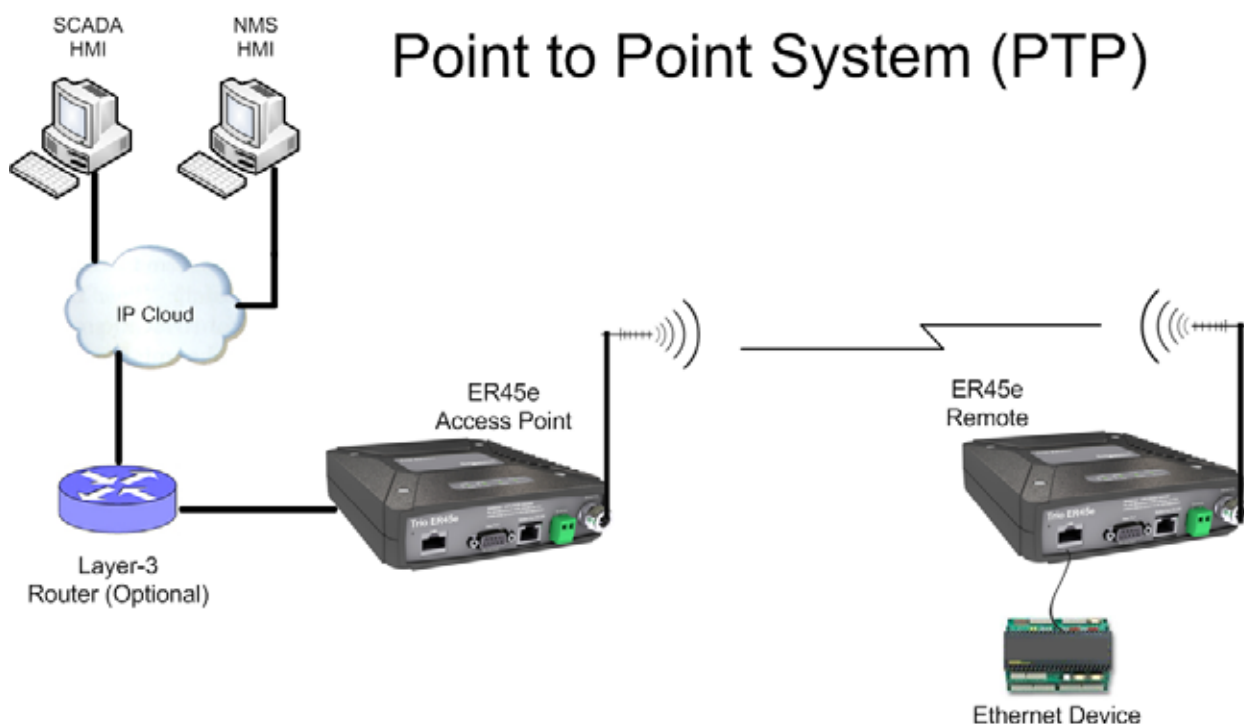
Point–to–Multipoint Networks (PTMP)

A Point to Multipoint (PTMP) network is normally chosen when one site (i.e.: The HOST) needs to broadcast messages to multiple REMOTE sites.

Point to Multipoint (PTMP) operation requires the Access Point site to have adequate RF coverage of all Remote sites. A PTMP offers the best available bandwidth and data latency when multiple remote sites are required.

Point to Multi-Point (PTMP)
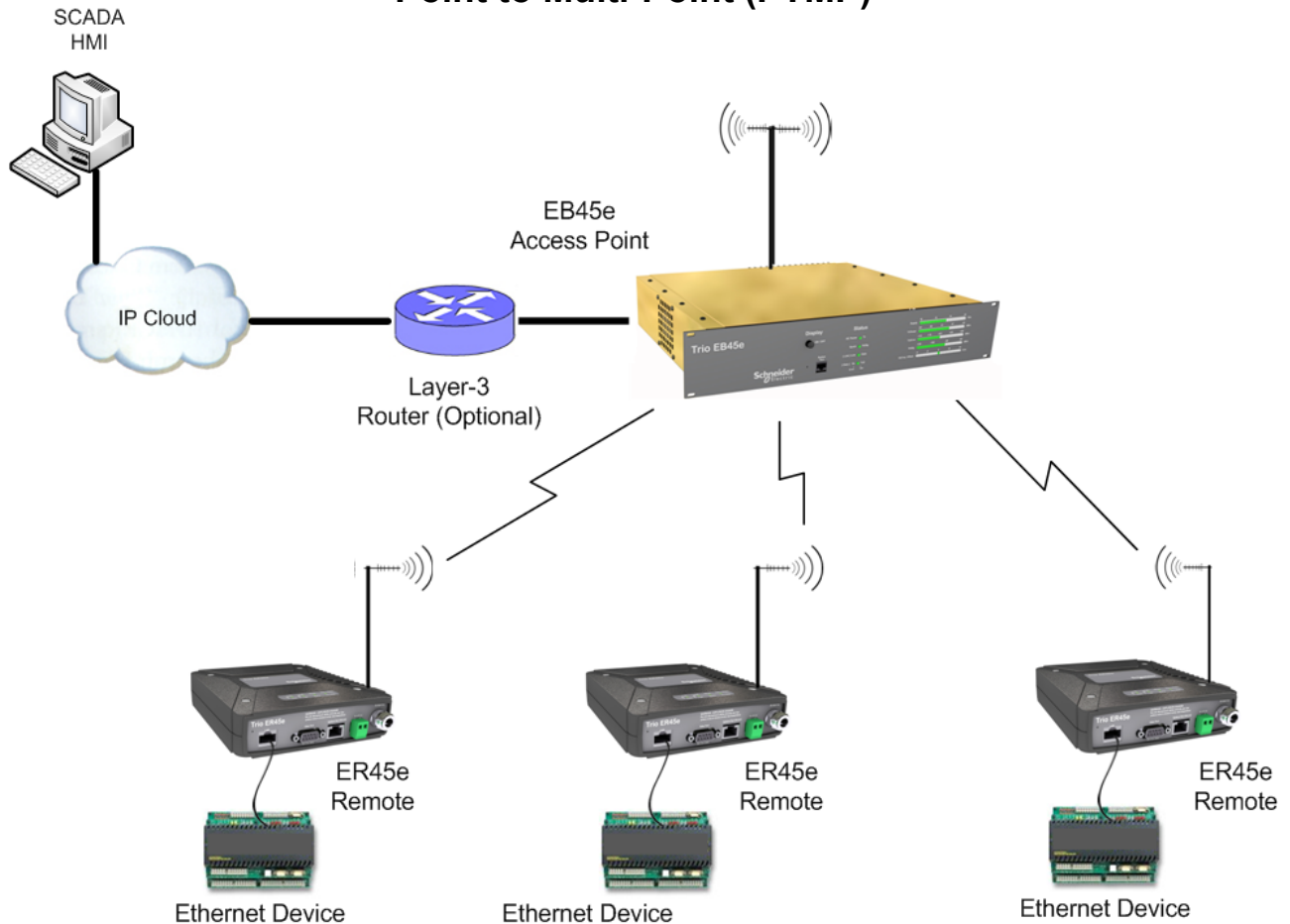
In a multiple access radio system (MAS),user data is broadcast from one common site (the Access Point) to all others, either using a half duplex or simplex radio channel.

To facilitate efficient data communication and support features such as collision avoidance, it is recommended that the Access Point be a full duplex radio. Utilizing a half duplex access point is possible, however system restrictions and RF collissions must be considered.

For serial data, the SCADA host must support an addressing system such as a DNP or MODBUS device address, since the Access Point broadcasts this data to all remotes. Ethernet data is transported transparently and end devices will identify information for themselves using the Ethernet/IP header information.

This type of system topology is the most efficient PTMP topology and should always be implemented if possible.

Digipeater Systems

A Point to Multipoint via repeater network is a variation of the Point To Multipoint network. It is normally chosen when the site where the SCADA (i.e.: Data) entry point does not have adequate RF coverage of other Remote sites in the network. The network diagram is shown below.

In this network topology, the Access Point radio is configured as a Repeater. The repeater should be located at a site with adequate RF coverage to each of the remotes. The Repeater still behaves as an Access Point to the Remotes as in a Point to Multipoint network, but the Repeater is configured to repeat data messages between remotes in the network. It therefore allows peer to peer communication to occur between remotes.

Because the Access Point radio now needs to "Repeat" data, data latency for messages from the Host Application to/from the Remotes will be longer. However, the Repeater/Access Point is normally a full duplex device and this means it is capable of receiving and transmitting repeated data simultaneously.

All other aspects of the Point to Multipoint network apply to this network topology.

Point to Multi-Point Via a Repeater (PTMP/R)
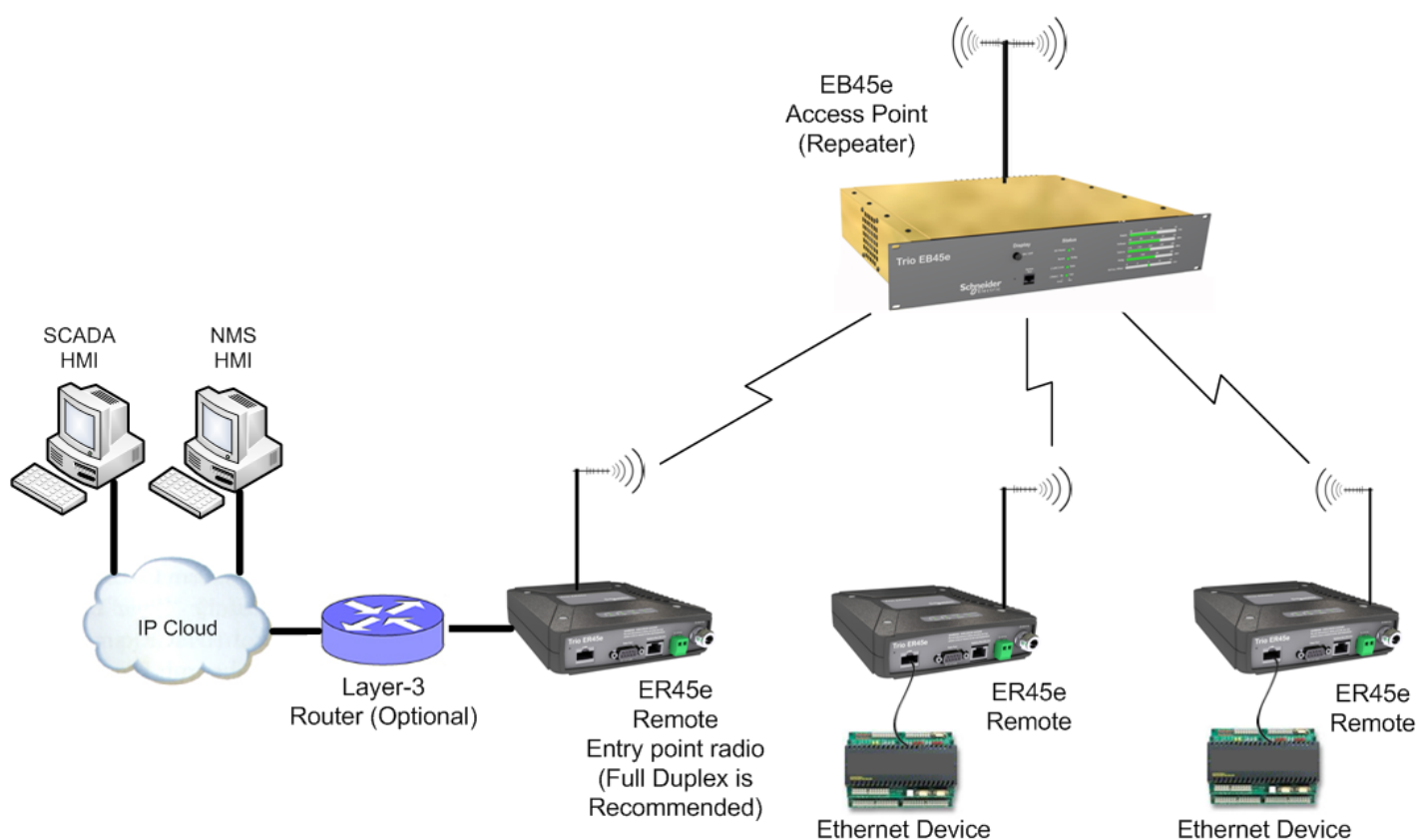
Part D – Features

Ethernet Features

Smart peer to peer repeating

Smart peer to peer repeating improves the available bandwidth in systems where peer to peer connectivity is required. The filtering is implemented within the Access Point of a PTMP system. Essentially, it prevents the unnecessary repeating of Ethernet traffic which is inherently point to point in nature (i.e. a TCP session). When two remote radios need to communicate with each other (often referred to as Peer to Peer), the Access Point will repeat the traffic to provide peer to peer connectivity. However, if the traffic is from a remote to a device connected to an Access point, then peer to peer repeating is not required and the Access Point will not repeat the traffic. The Access Point learns what devices (MAC addresses) require repeating. By learning where devices are located on the network, the route table does not require any special configuration or setup. If a messages has a broadcast address and peer to peer is enabled, the message will be repeated. If peer to peer connectivity is not required, it can be disabled to prevent the unnecessary repeating of broadcast traffic.

Ethernet filtering

Ethernet filtering provides an easy to configure Layer 2 filtering mechanism, which can prevent unnecessary Ethernet traffic increasing channel loading. There are various different addressing methodologies that can be filtered, which include:
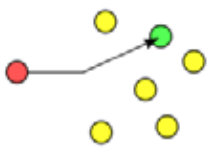
Unicast:

Unicast is an addressing methodology that delivers messages to a single network destination identified by a unique address.
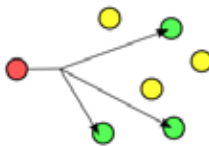
Multicast:

Multicast is an addressing methodology that delivers messages to a group of destination addresses simultaneously in a single transmission. Spanning tree messages are an example of multicast messages.
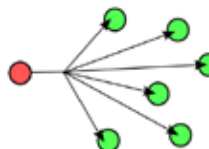
Broadcast:

Broadcast is an addressing methodology that delivers messages to every device on a network. The broadcast address of a device is calculated from the subnet mask. If all devices within a network use a common network mask, the broadcast address will also be common.

Although typical SCADA applications only require Unicast & ARP data, the filtering mechanism provides the option to allow:

- All Ethernet traffic
- Unicast & ARP only (ARP is primarily used by networks to identify which physical devices own which IP addresses).
- Unicast only (Only used when a MAC address table is statically assigned).
- Or allow traffic from a single MAC address only.

Although Spanning tree messages are multicast messages, they are also filtered out unless the user is allowing all Ethernet traffic to pass. This is also to prevent unnecessary channel loading.

Data Compression

Ethernet SCADA data is highly compressible due to continuous sequences of ones and zeros. Compression will minimise the amount of RF channel loading by compressing all Ethernet data transmitted that is sent over the air. Compression is applied to all Ethernet data which can significantly improveme data throughput and latency.

SNMP Diagnostics

The Ethernet E-Series can provide SNMP diagnostic data via an internal SNMP agent. The radio supports SNMP v1 & v2c along with notifications which includes traps and informs. SNMP facilities include RFC1213, Ethernet diagnostics and radio diagnostics

The features and benefits of SNMP diagnostics include:

- SNMP messages/notifications can be sent to Clear SCADA or SNMP management software.

- SNMP notifications provide real time alarm reporting.

- Eliminates the need for radio polling.

- Radios can send diagnostic information via SNMP periodically (diagnostics heartbeat).

Schneider Electric supply .MIB files that can be imported into most major SNMP Management consoles. These .MIB files define the contents of the SNMP parameters including a description for each parameter. The parameters are sorted into six distinct groups. The general group, the radio group, the security group, the lan group, the error group and the notification group. More information on SNMP can be found in Part F of this user manual.

SNMP Notifications

As of Ethernet E-Series firmware version 5.5.0, the Ethernet E-Series has the capability to send SNMP notifications. An SNMP notification is a message to inform a user that some sort of state of the radios has changed, these states include; input voltage, temperature, Tx power, etc. There are two types of SNMP notifications available which are traps and informs.

- A trap is a single UDP message that is sent from the Ethernet E-Series to a user defined SNMP manger.

- An inform is still a UDP message, however, an inform requests a response to the UDP message sent. This allows retries and time outs to be used within the radio.
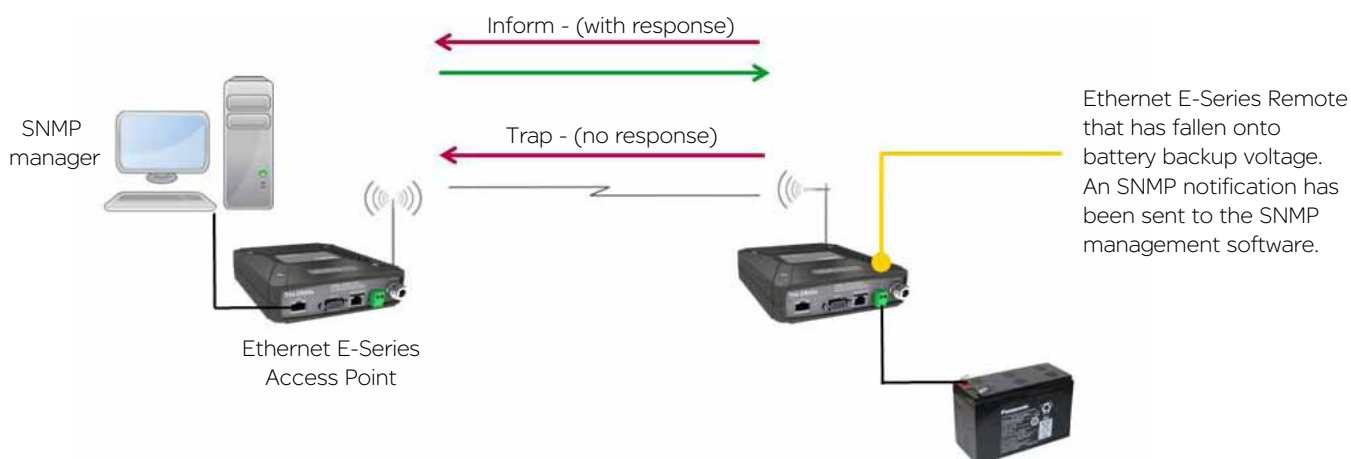
Network Management and Remote Diagnostics

Network wide operation from any radio modem

Remote diagnostics can be accessed from any radio to any other radio within a network. Using remote diagnostic will not overload the RF channel or interfere with User data. For detailed information on TView+ diagnostics please refer to the TView+ diagnostics user manual.
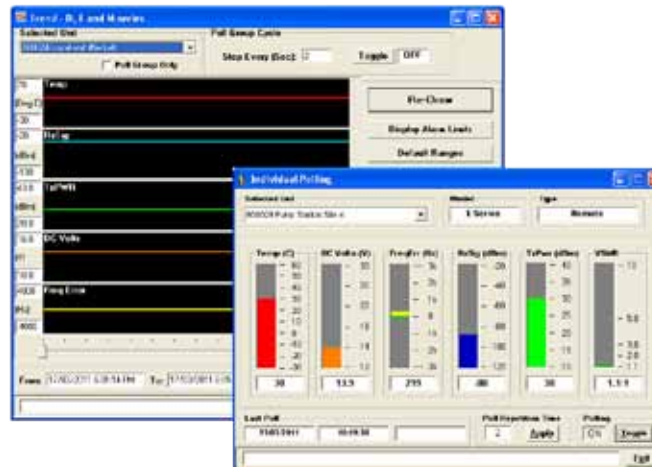
Over the air firmware updates

TView+ Management Suite provides an over the air firmware update tool for Ethernet E-Series. The firmware update feature is speed limited to prevent RF channel congestion and can broadcast to all of the remotes within an Ethernet E-Series system. Broadcasting to all remotes has the benefit of upgrading the alternative firmware pack in many radios simultaniously, without the need to send firmware to each remote radio individually. Due to the speed limiting of the firmware upgrade process, SCADA data will not be blocked or interfered with while firmware packs are being transferred.

Each radio stores two sets of firmware. The current firmware pack is the firmware the radio is running from. The alternative firmware pack is a secondary (optional) area where alternative firmware can be stored. When the alternative firmware pack has been updated, it can then be activated which moves the alternative firmware into the current firmware pack area, and causes the radio to reboot using the new firmware.

The firmware upgrade tool also provides the capability of individual activation or group activation, depending on user preference.

Firmware upgrades are typically done using "patch" files where only the difference between the current and target firmware is actually sent. This reduces the over the air transmission of firmware data by 90%.

Remote reconfiguration

Remote configurations is designed for the remote (over the air) configuration of radios. There are two methods of performing remote configurations:

- Via a serial connection: This method requires the serial number of the radio being targeted.

- Via eConfig (Ethernet connection): This method requires the serial number of the radio being targeted and the IP address of the entry point radio (which must have the eConfig server enabled).

Over the air configurations provide the following benefits for users:

- Remote reconfigurations use a small amount of bandwidth to prevent any interference with User data.

- Eliminates the need for site visits when reconfigurations are required on remote sites.

eDiags

eDiagnostics (also known as eDiags) is a feature of the TView+ Diagnostics software that encapsulates the TView+ Diagnostics protocol in an Ethernet UDP/IP packet. Together with the eDiags server built into each Ethernet E-Series radio, the user can monitor an entire Ethernet E-Series radio network using the TView+ Diagnostics software over an Ethernet LAN/WAN. This eliminates the need for serial backbone to monitor using TView+.

For more information on the features and benefits of the TView+ Diagnostics software, please refer to the TView+ Management suite Suite Brochure and for additional technical details, the TView+ Diagnostics User Manual.

The Ethernet E-Series supports eDiags allowing radio diagnostics traffic to be carried over an IP cloud. The operation of eDiags is as follows:

eDiags Port Settings

(1) The TView+ Diagnostics software is installed on a PC and the system design provides Ethernet connectivity between the PC and the Diagnostics entry point radio of the Ethernet E-Series radio network.

(2) The TView+ Diagnostics software on the PC is configured with the following items:

- Create a list (database) of Ethernet E-Series radios that need to be polled for diagnostics. The IP address and eDiags listening ports for each radio within the system should follow that of the Diagnostics Entry point radio. This will minimise the amount of IP and Ethernet overhead transmitted over the air. The serial number for each unit must be individually specified as well as any other information i.e Location/Name.

- Define a local listen port for incoming eDiags messages (ie: Diagnostics responses from the Diagnostics entry point radio)

(3) Only the Diagnostics entry point radio needs to have eDiags configured and enabled. This prevents unnecessary Ethernet/IP overhead frombeing sent over the narrowband channel.

- eDiags must be enabled (it is disabled by default)

- The eDiags local listen port must be configured. This is the port on which the eDiags server listens for incoming eDiags polls from the TView+ Diagnostics software. The eDiags remote IP address & port must be configured. This is the IP address of the PC running the TView+ Diagnostics software. The port is the eDiags listening port on the PC.

PC running TView+ Diagnostics
PC Locacl IP: 192.168.2.1
eDiags Local Listen Port: 4001

Diagnostics Entry point Radio
Local IP: 192.168.2.5
eDiags Local Listen Port: 4001
eDiags Remote IP: 192.168.2.1
eDiags Remote Port: 4001
*A secondary IP address can be configured for redundant systems.

eDiags Settings for poll group
Every units eDiags settings should follow that of the Diagnostics entry point radio.

IP Cloud

Redundant SCADA host

Remote unit
eDiags disabled

Remote unit
eDiags disabled

Remote unit
eDiags disabled

eConfig

eConfig allows access to the radio's configuration via an Ethernet connection.

To read an Ethernet E-Series via eConfig, there must be one of two things first established:

1) eDiags enabled within entry point radio. (Note: the eDiags server is also called the eConfig server).

2) OR a terminal server installed.

The example below will show how to perform eConfiguration using method 1 - eDiags enabled within the entry point radio.

- To begin with, the eDiags server must already be enabled & configured within the entry point radio. For configuration instructions on eDiags, please refer to Part F - Quick Reference Guide.

- The diagram below shows a typical point to point radio topology with eDiags enabled within the entry point radio.

PC:
IP: 192.168.2.10

Access Point:
Serial number: 600210
IP: 192.168.2.15
eDiags enabled
eDiags local port: 1040
Remote IP address: 192.168.2.10
Remote IP port: 1040

Remote Radio:
Serial number: 600220
IP: 192.168.2.16
eDiags Disabled

IP Cloud

Access Point
(radio system entry point)

Remote Radio
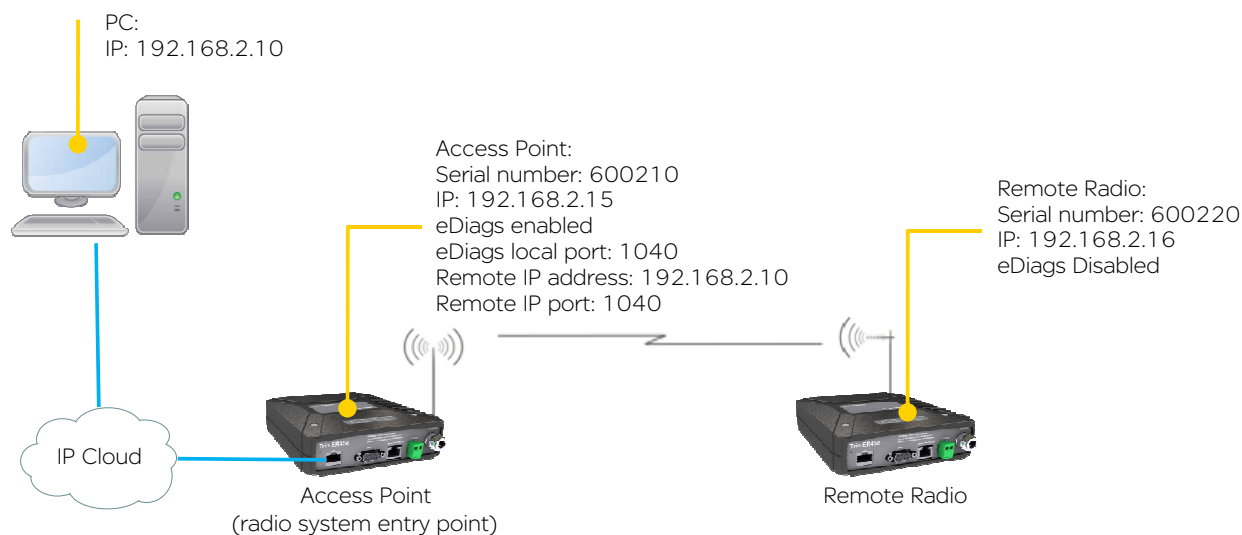
Example: Performing an eConfig read

1) Open the E-Series TView+ Programmer and go to: Setting -> eConfig. As shown below.
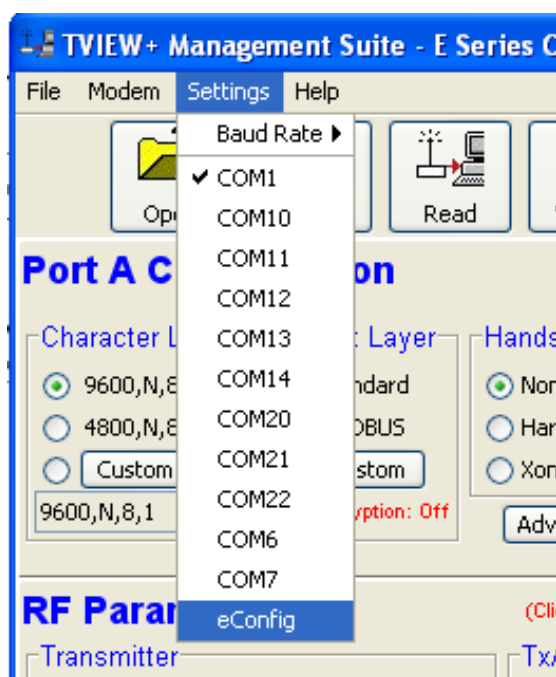
2) Once eConfig is selected as the communications port, Press the read button. This will open a new window shown below.
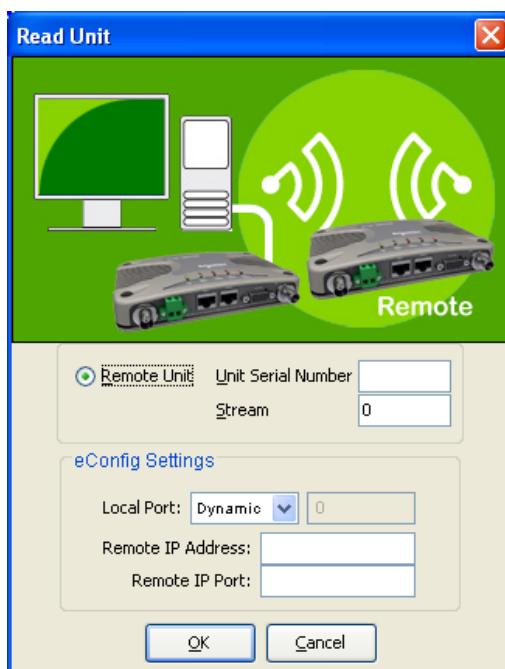
3) In this example, we are going to access the remote radio, so we must fill in the address details to ensure we target it. in reference to the point to point diagram on the previous page we would fill the read unit details in with the following information to access the remote radio. Once the details are filled, press OK and the eConfig read will commence.
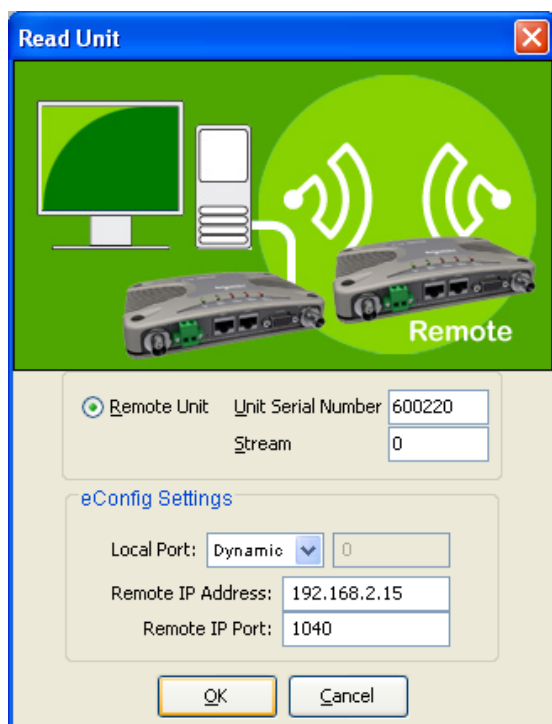
- The unit's serial number defines which unit the programmer will attempt to establish a configuration session with. In this example, the Remote radio is being targeted, however, any radio within the radio network may be targeted via it's serial number.
- The eConfig settings defines the Ethernet entry point to the radio network. In this example, the Access point is the Ethernet Entry point to the radio network. The eConfig server will behave as a transparent mediator between the SCADA host PC and the radio being targeted (the radio being targeted may also be the entry point radio).
- Note: the Local port can either be dynamic or static. if you select static, the Local port must match the 'Remote IP port' setting in the target radio. in this example is would be: 1040.
- Dynamic port selection - to use a local dynamic port, the radio you are performing a read on must be operating firmware version 5.5.0 or later in order to support this.

Hot Standby Redundant Ethernet Connections

Ethernet Link Monitoring

The Ethernet Link monitoring feature has been designed to allow each base station in a hot standby arrangement to monitor the Ethernet link to the SCADA host or Master RTU/PLC. Each base monitors the network for functional Ethernet link connectivity by pinging a primary and a secondary IP address (typically the SCADA host(s)) and checking to see that a response is received. This ensures that the Hot Standby arrangement does not change over to a base unit that has no Ethernet link connectivity.

The following example shows how the Ethernet link monitoring works:

- Both base units in an EH Hot Standby "Ping Test" a Primary IP address (ie: Host A) to ensure the Ethernet network path is healthy

- If the primary IP fails to respond, the link is declared a failure unless a secondary IP address is configured, then it will be pinged (ie: Host B).

- In the event that both primary and secondary IP addresses do not respond to the ping test, the base declares its "Ethernet" link has failed.

- If the failed base is online a hot standby change-over is initiated

- Ping test fail counters and wait times are user configurable.

- Time between pings and failure count threshold are user configurable.

Managed Switch configuration
- Each EB Base Ethernet port is connected to the managed switch

- The MAC Address Cache Max-Age time in the switch should be set to the minimum value (preferably 0) to disable caching in the switch. This gives control of the MAC Address cache to the online base which ensures fast link re-establishment after base change over.

Host A

Switch/Router
Cisco 2900 or Similar

WAN

Managed Switch
Cisco 2960 or similar

Trio EB45e
Trio HSC
Trio EB45e

Host B

IP Router
- The IP router can be configured to prevent unnecessary Ethernet traffic being transmitted over the SCADA radio network

- Spanning Tree Protocol and Broadcast Traffic are typical sources of unwanted traffic

Hot Standby Controller Shared IP

The Hot Standby Controller Shared IP address can be used to access SNMP, Web server configuration menus, Telnet, eDiags, eConfig and Terminal server functions within the "on-line" base. Each EB Base will still retain an individual IP address. Only the "on-line" base will respond to the shared IP address.

When a Hot Standby changeover occurs, the new "on-line" base issues a Gratuitous ARP to inform any device with a MAC cache (SCADA Host PC, Switch) that the MAC address has changed for the device owning the Common IP Address.

Terminal Servers

A terminal server allows serial data to be transported over a LAN/WAN. Normally, systems require a standalone terminal server to integrate external serial devices at remotes sites into a managed LAN/WAN. The Ethernet E-Series provides the functionality of two embedded terminal serves which avoids the requirement for an external terminal server. The examples below show two systems, one using an external terminal server and one using the Ethernet E-Series embedded terminal server.

Example: Traditional system without Ethernet E-Series embedded Terminal server

SCADA HMI

IP Connection between SCADA HMI and Terminal Server

Serial Connection between Terminal Server, Base, Remote and external serial device

Remote

Serial Device

IP Cloud

Terminal Server

Base

Remote

Serial Device

Example: System using Ethernet E-Series embedded Terminal server

IP Connection between SCADA HMI and Base

Serial Connection between Base, Remote and external serial device

Remote

Serial Device

IP Cloud

Base

Remote

Serial Device

Terminal Server (Virtual) Mode

When operating in virtual terminal server mode, the remote radio provides the same functionality as if there was an external terminal server at the entry point of the system (typically a base station).

The virtual terminal server is designed to minimize the over the air bandwidth requirements by converting IP encapsulated serial data into raw serial data. The result is that serial data can be carried over the RF channel much more efficiently than IP encapsulated serial data, which contains additional IP and Ethernet MAC overhead for each packet of serial data transmitted. Features of the Embedded terminal server include:

- Support two independent fully configurable Virtual terminal servers.
- Supports three transport protocols; TCP, UDP and PPP.
- Supports three modes of TCP operation; Client mode, Server mode and Client/Server mode.
- User configurable port numbers.
- Supports up to 4 simultaneous TCP connections when operating in server mode.
- Supports trunk and user port mode (Refer to part G user port and trunk port)

Below is an example of serial data carried over a LAN/WAN using TCP transport to the embedded terminal server of the Ethernet E-Series base. Essentially, the Virtual Terminal server behaves as if an external terminal server was placed between the IP connection (from the cloud) and the serial port of the entry point radio, the entry point radio in this example is the base station.

Using TCP with Virtual Terminal Server Functionality

SCADA HMI
192.168.5.200

TCP Connection between x.200 (SCADA HMI)
and x.5 (Base station)

DNP RS232 Connection between EB45e,
ER45e #1 and external serial device

ER45e #1
192.168.5.10

Serial Device

SCADA host:
TCP client creating
connection to Base station
192.168.5.5:4001

IP Cloud

ER45e #2
192.168.5.20

Serial Device

EB45e
192.168.5.5

Base:
Interface : Virtual Terminal A
Port Type : User
Tx SID = 1, Rx SID =1
Protocol : TCP
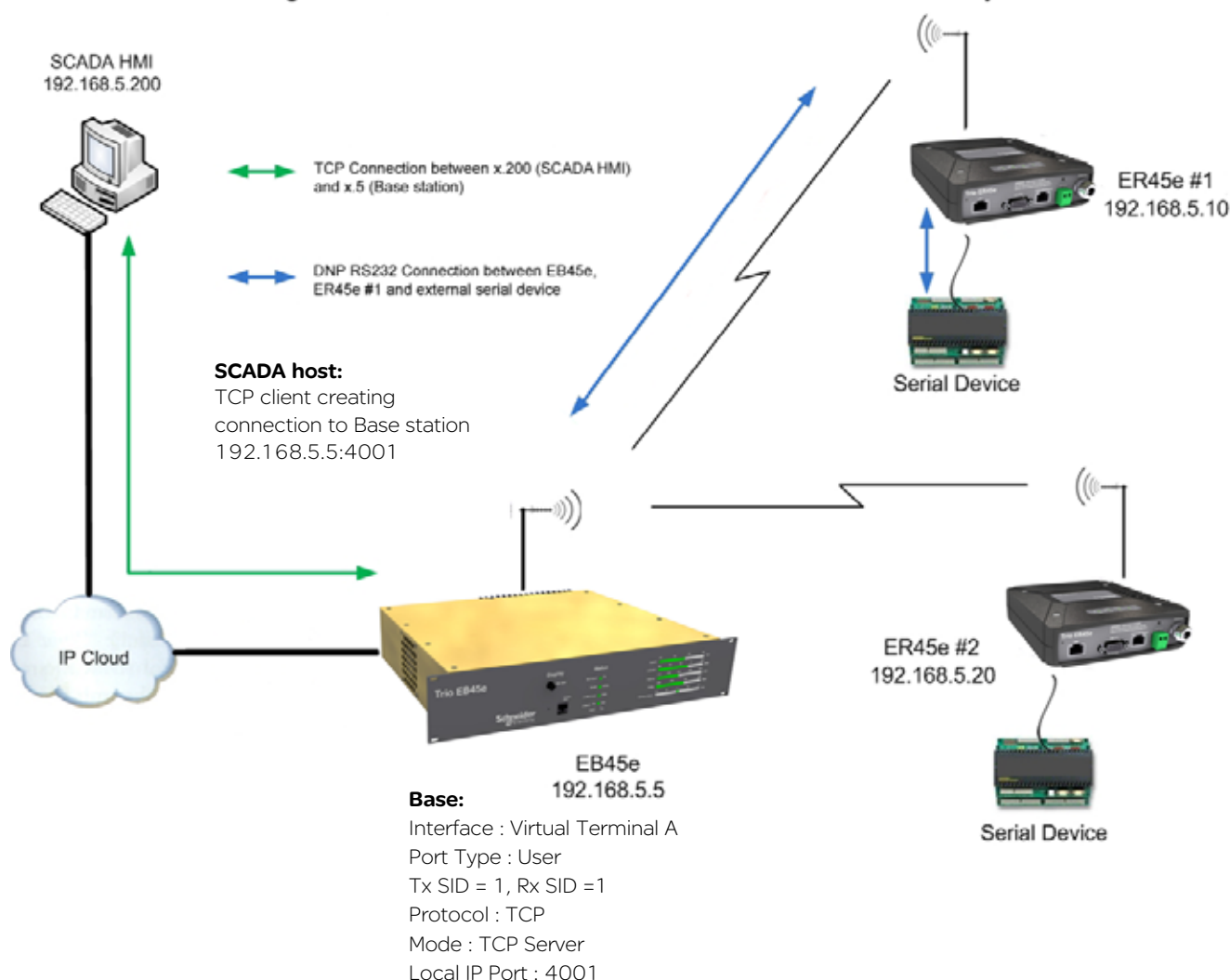Mode : TCP Server
Local IP Port : 4001

Device Srv (Server) Mode

When operating in device server mode, the remote radio provides the same functionality as if there was an external device server at each remote site.

Device Server mode provides an easily configurable mechanism for transporting serial traffic that does not have any built in addressing. The benefit of the device server feature is that device addressing can be performed using IP addresses for non addressable serial protocols, without the need of external terminal servers or managing serial devices using the IP address of the remote radio.

Features of the device server are the same as the features of the virtual terminal server on the previous page.

The diagram below shows a typical setup using the device server functionality in remote radios.

Using TCP with Device Server Functionality
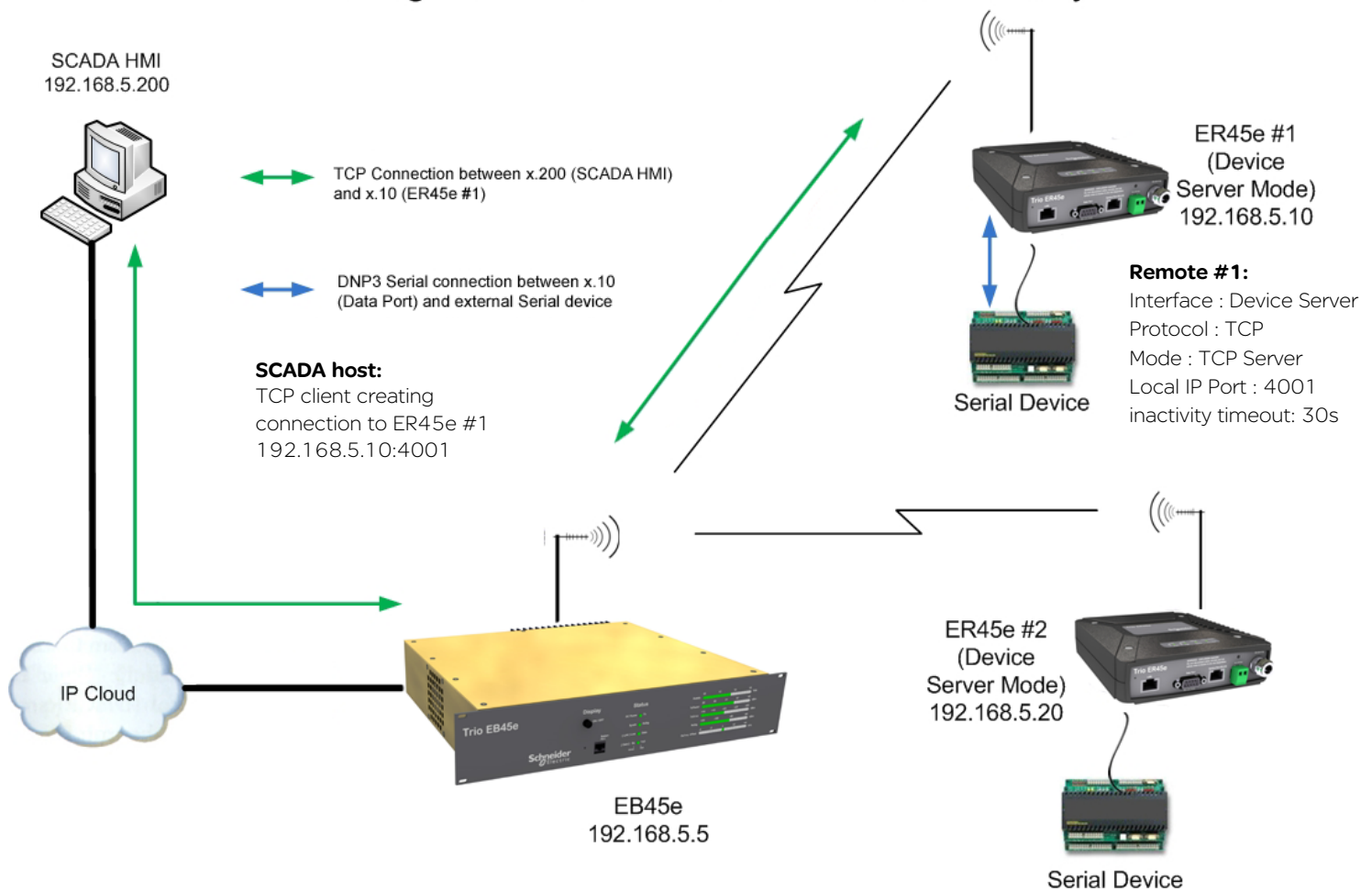
MODBUS gateway

The Ethernet E-Series has a MODBUS Gateway feature that can be enabled to function like an external MODBUS gateway. The MODBUS gateway is a protocol converter between MODBUS/TCP and MODBUS RTU protocols. The gateway is an addition to both the Device Server and Virtual Terminal Server features.

When operating in virtual MODBUS gateway mode, the remote radio provides the same functionality as if there was an external MODBUS gateway at the entry point of the system. In traditional systems, standalone MODBUS gateways were required to convert the IP MODBUS TCP protocol to MODBUS RTU, the example below shows a traditional MODBUS TCP system using a stand alone MODBUS gateway.

Example: Traditional system without Ethernet E-Series embedded MODBUS gateway

IP Connection between SCADA HMI and MODBUS gateway

Serial Connection between Terminal Server, Base, Remote and external serial device

Remote

Serial Device

IP Cloud

MODBUS gateway

Base

Remote

Serial Device

Example: System using Ethernet E-Series embedded MODBUS gateway

IP Connection between SCADA HMI and Base

Serial Connection between Base, Remote and external serial device

Remote

Serial Device

IP Cloud

Base

Remote

Serial Device
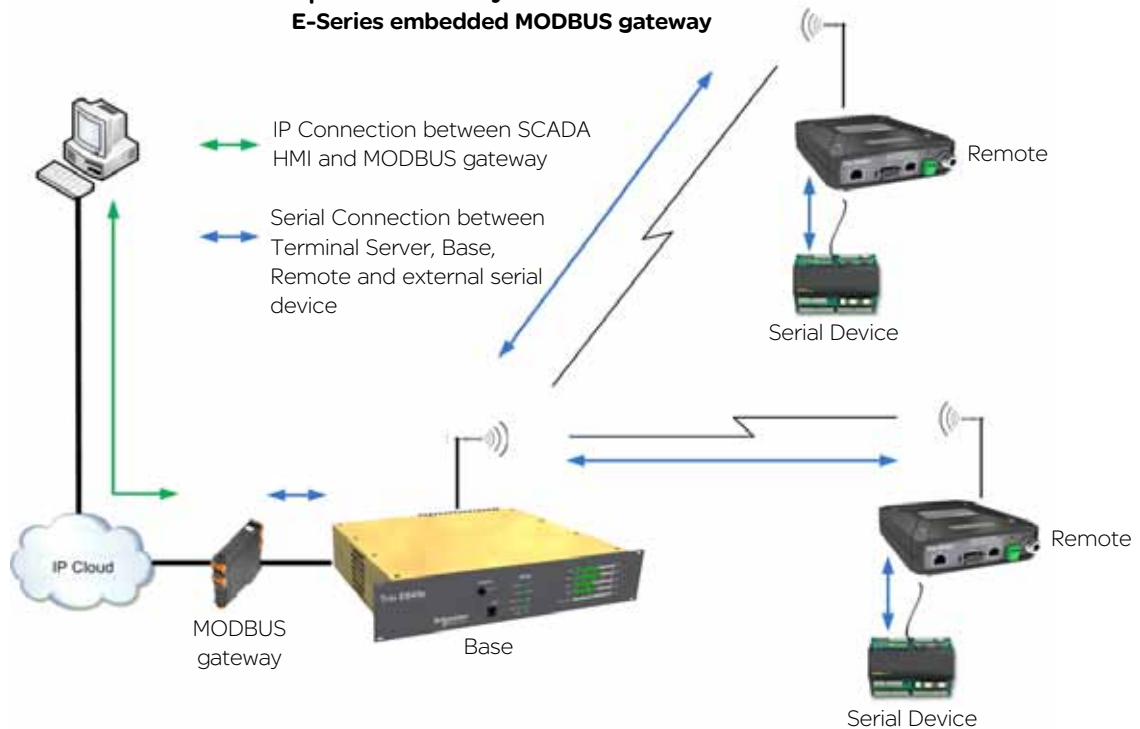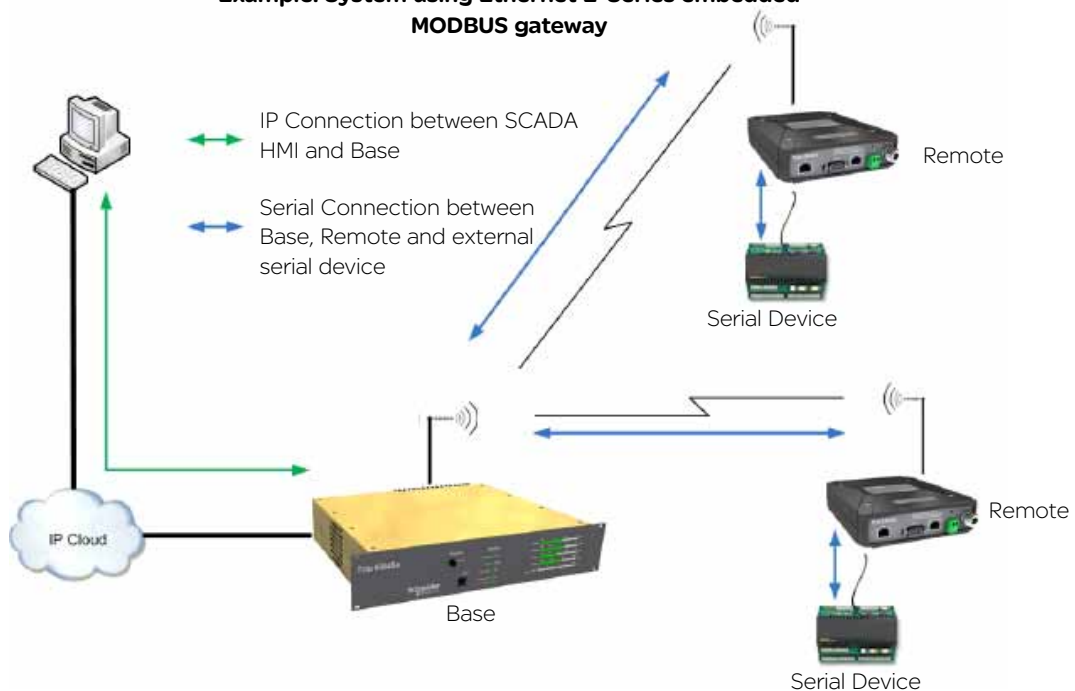
MODBUS gateway (Virtual)

When operating in Virtual MODBUS gateway mode, the remote radio provides the same functionality as if there was an external MODBUS gateway at the entry point of the system (typically a base station).

The virtual MODBUS gateway ports are designed to minimise the over the air bandwidth requirements by converting IP MODBUS TCP data into MODBUS RTU serial data . The result is that MODBUS RTU serial data can be carried over the RF channel much more efficiently than IP MODBUS TCP, which contains additional IP and Ethernet MAC overhead for each packet of data transmitted.

Features of the embedded MODBUS gateway include:

- Support two independent fully configurable Virtual MODBUS gateways.
- Supports two transport protocols; TCP and UDP.
- Supports two modes of TCP operation; Client mode and Server mode.
- User configurable port numbers.
- Supports up to 16 simultaneous TCP connections when operating in server mode.
- Supports user port mode (Refer to part G user port)

Below is an example of MODBUS RTU serial data being carried over a LAN/WAN using TCP to transport to the embedded MODBUS gateway of the Ethernet E-Series. Essentially, the Virtual MODBUS gateway behaves as if an external MODBUS gateway was placed between the IP connection (from the cloud) and the serial port of the entry point radio. In the example below, the base station is the entry point radio.

Using TCP with MODBUS gateway (virtual) Functionality
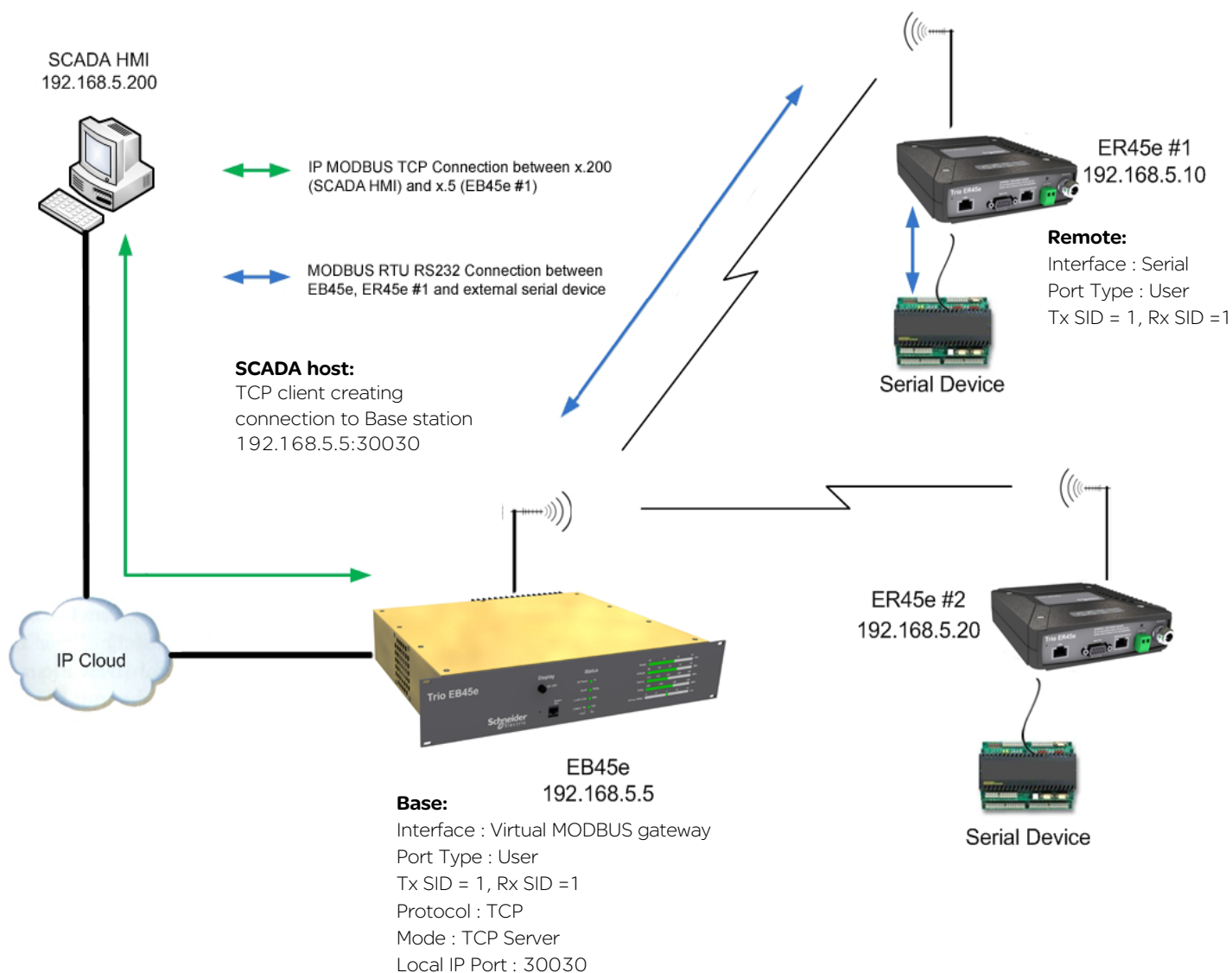
MODBUS gateway (remote)

When operating in MODBUS gateway (remote) mode, the remote radio provides the same functionality as if there was an external MODBUS gateway at each remote site.

Features of the MODBUS gateway (remote) are the same as the features of the MODBUS gateway (virtual) on the previous page.

MODBUS gateway mode provides an easily configurable mechanism for transporting serial traffic over an IP network (LAN/WAN). The result of the MODBUS gateway feature is that the limitation of MODBUS addressing (0-255) can be ignored as the IP address of the radio can be used giving unlimited addresses to external equipment such as RTUs or PLCs. Below is an example of a typical system using the MODBUS gateway (remote) feature at each remote site to avoid the limitation of MODBUS addressing.

Using IP MODBUS TCP with MODBUS gateway funtionality
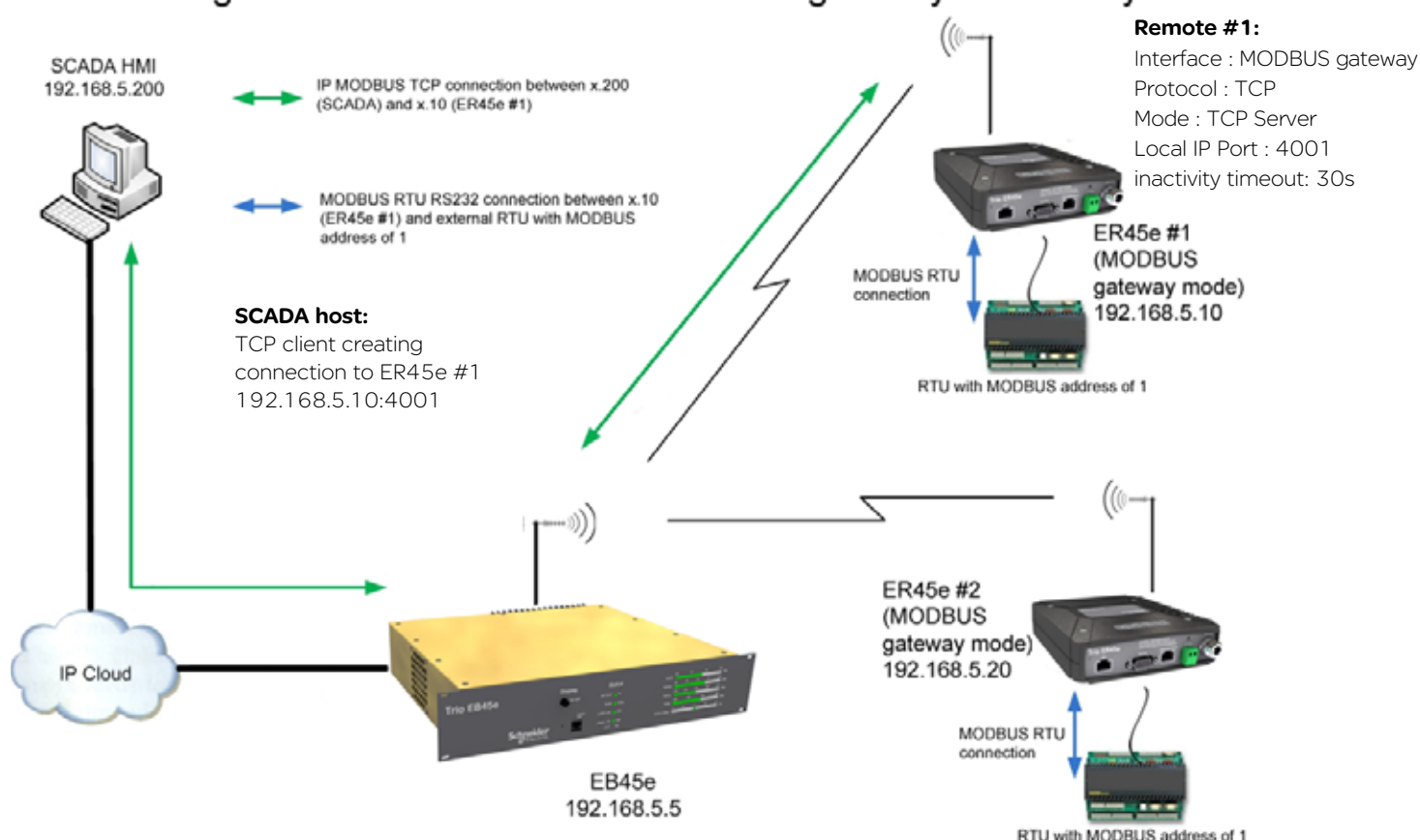
Connectivity

Independent Ethernet & Serial ports

Ethernet Port
The Ethernet E-Series is equiped with a single Ethernet port. This port is compatible with most Ethernet protocols. The Ethernet Port is 10/100Mbps, auto MDI/MDIX sensing (NO cross over cables required). The Ethernet port operates in a Layer 2 Bridge mode.

Serial Port
The Ethernet E-Series is equipped with a single Serial port. This port is compatible with most RS-232 SCADA & Telemetry protocols. The port's Interface speed is user selectable (300 - 38.4 kbps asynchronous). A physical Serial port can interface with an embedded terminal server.

Separate on-line system port
The separate system port avoids the need to interrupt user data for configuration access. The system port is always enabled – compatible with the TView+ E&K programming cable and provides diagnostics and configuration access without requiring a reboot or going into any special modes.

The system port also provides the ability to activate the transmitter for diagnostics and commissioning tests.

Radio and Modem Features

Radio

Remotes are available in half duplex & simplex modes (useful for remote sites in PTMP systems). They are also available in a full duplex version (useful for PTP links). Full duplex allows Tx & Rx operation to occur simultaneously.

Power Supply

The ER45e remote will operate between a DC voltage range of 10 - 30V (13.8VDC Nominal). This eliminates the requirement of DC-DC converters on sites operating at 24VDC.

Ethernet E-Series base stations and hot standby controllers operate between a DC voltage range of 11 - 16 V (13.8VDC Nominal).

Collision Avoidance

ChannelShare™ unique integrated C/DSMA collision avoidance technology permits simultaneous polling and spontaneous alarm reporting operation in the same system. Collision avoidance operates on the principle of one device, called the collision avoidance master, managing remote access to the RF channel.

Collisions will occur on the receiving channel of the master, due to two or more remotes transmitting simultaneously. ChannelShare™ minimizes the chance of collisions by using the collision avoidance master to inform remotes when access to the RF channel is available.

Remotes will check whether the master is allowing access to the channel before a transmission occurs. If the channel is free, the remote will transmit, if the channel is busy, the remote will buffer the message and execute a small random delay (in case multiple remotes have data to send), then attempt to access the channel again.

There are two different modes of operation that ChannelShare™ can use:

Carrier Detect – which uses the TX carrier of the collision avoidance master to indicate if channel is busy

Digital – which requires a permanently keyed (transmitting) collision avoidance master.

In this mode the busy state of the channel is indicated by a digital data stream bit constantly transmitted by the master. This mode of collision avoidance has a smaller collision window than the carrier detect mode.

In digital collision avoidance mode, the remote radio can be programmed for two types of operation:

Remote Tx data 'Priority':(Original remote default)
- Tx Priority only observes the digital collision avoidance masters channel busy flag. Essentially this mode waits for the channel busy bit to be clear then it will send any data it needs to.

Remote Rx data 'Priority':
- In some Ethernet systems, particularly where multiple threads are started (ie: browsing web pages), a problem can occur due to the half-duplex nature of the radio. The problem may occurs because the remote will prioritising Tx data, which may potentially corrupt incoming Rx data. To prevent this, enabled the Remote Rx data Priority mode. Rx Priority does not only observe the digital collision avoidance masters channel busy flag, but also gives priority to incoming data being received. Essentially this mode waits for incoming data to be complete, then it sends the data (proving the channel busy flag is still clear).

Multistream^{TM} functionality (SID codes)

Due to the non addressable nature of Serial only data, Stream Identification (SID) codes have been implemented to give users the ability to route Serial messages to their correct destinations. Addresses can be implemented between a range of 0-255. These SID codes will create virtual circuits between sites to allow message routing.

Serial Digipeater Operation

The Ethernet E-Series has the ability to internally repeat serial data packets to provide stand alone repeater facilities without the need for external intelligence.

Security

Secure operation with 128-bit AES encryption**

The 128-bit AES encryption feature can provide an encrypted channel that prevents eaves-dropping and snooping. The effort for configuration is minimal as the radio automatically adjusts, to keep packet transport compatible (i.e.: MODBUS messages are not broken up). Enabling encryption requires additional overhead depending on packet sizes being sent. For more detailed information, refer to Trio tech note TN80.

Password Protected Configurations

Configuration information can be protected by a user definable password. When a password is set, the programmer will request the password each time the radio is read. No configuration information can be displayed or changed without the correct entry of the password.

Part E – Getting Started

Understanding RF Path Requirements

A radio modem needs a minimum amount of received RF signal to operate reliably and provide adequate data throughput.

In most cases, spectrum regulatory authorities will also define or limit the amount of signal that can be transmitted, and the transmitted power will decay with distance and other factors, as it moves away from the transmitting antenna.

It follows, therefore, that for a given transmission level, there will be a finite distance at which a receiver can operate reliably with respect to the transmitter.

Apart from signal loss due to distance, other factors that will decay a signal include obstructions (hills, buildings, foliage), horizon (effectively the bulge between two points on the earth), and (to a minimal extent at UHF frequencies) factors such as fog, heavy rain-bursts, dust storms, etc.

In order to ascertain the available RF coverage from a transmitting station, it will be necessary to consider these factors. This can be done in a number of ways, including

(a)   using basic formulas to calculate the theoretically available signal - allowing only for free space loss due to distance,

(b)   using sophisticated software to build earth terrain models and apply other correction factors such as earth curvature and the effects of obstructions, and
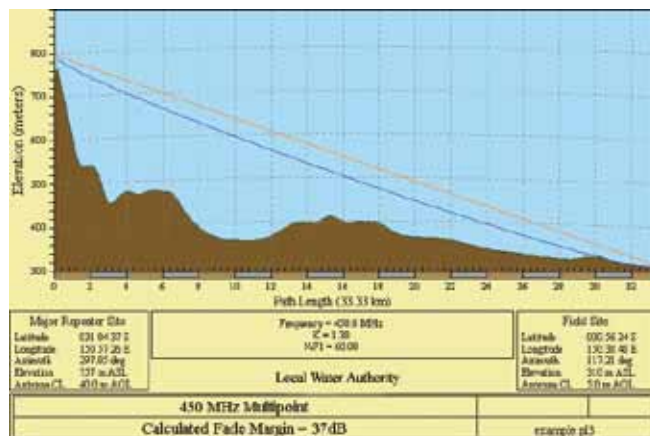
(c)   by actual field strength testing.

It is good design practice to consider the results of at least two of these models to design a radio path.

Examples of Predictive Path Modelling

Clear line of site

Radio path with good signal levels, attenuated only by free space loss.

Obstructed Radio Path

goodpath.pl3	Major Repeater Site	Field Site
Elevation (m)	756.69	309.67
Latitude	031 04 37.49 S	030 56 24.00 S
Longitude	150 57 26.34 E	150 38 48.00 E
Azimuth	297.05	117.21
Antenna Type	ANT450/6OM	ANT450/9AL
Antenna Height (m)	40.00	5.00
Antenna Gain (dBi)	8.15	11.15
Antenna Gain (dBd)	6.00	9.00
TX Line Type	LDF4-50	LDF4-50
TX Line Length (m)	40.00	5.00
TX Line Unit Loss (dB/100 m)	6.79	6.79
TX Line Loss (dB)	2.72	0.34
Connector Loss (dB)	2.00	2.00
Frequency (MHz)	450.00	
Path Length (km)	33.33	
Free Space Loss (dB)	115.99	
Diffraction Loss (dB)	0.00	
Net Path Loss (dB)	103.75	103.75
Radio Type Model	EB450	ER450
TX Power (watts)	5.00	1.00
TX Power (dBW)	6.99	0.00
Effective Radiated Power (watts)	6.71	4.63
Effective Radiated Power (dBW)	8.27	6.66
RX Sensitivity Level (uv)	0.71	1.26
RX Sensitivity Level (dBW)	-140.00	-135.00
RX Signal (uv)	45.93	102.70
RX Signal (dBW)	-103.75	-96.76
RX Field Strength (uv/m)	453.14	545.42
Fade Margin (dB)	36.25	38.24
Raleigh Service Probability (%)	99.976	99.985

This path has an obstruction that will seriously degrade the signal arriving at the field site.
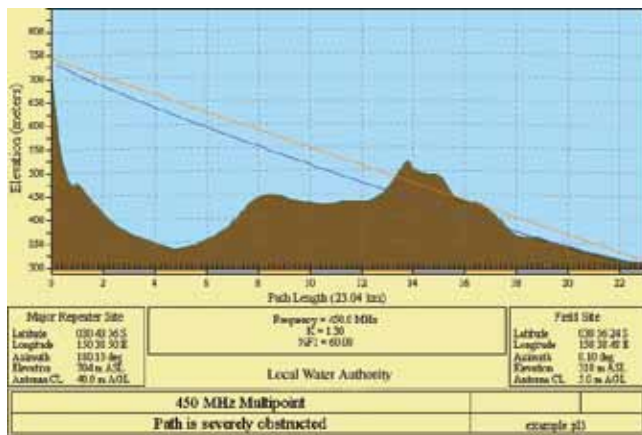
| obstpath.pl3	Major Repeater Site	Field Site
Elevation (m)	703.83	309.67
Latitude	030 43 55.92 S	030 56 24.00 S
Longitude	150 38 49.51 E	150 38 48.00 E
Azimuth	180.10	0.10
Antenna Type	ANT450/6OM	ANT450/9AL
Antenna Height (m)	40.00	5.00
Antenna Gain (dBi)	8.15	11.15
Antenna Gain (dBd)	6.00	9.00
TX Line Type	LDF4-50	LDF4-50
TX Line Length (m)	40.00	5.00
TX Line Unit Loss (dB/100 m)	6.79	6.79
TX Line Loss (dB)	2.72	0.34
Connector Loss (dB)	2.00	2.00
Frequency (MHz)	450.00	
Path Length (km)	23.04	
Free Space Loss (dB)	112.78	
Diffraction Loss (dB)	16.71	
Net Path Loss (dB)	117.25	117.25
Radio Type Model	EB450	ER450
TX Power (watts)	5.00	1.00
TX Power (dBW)	6.99	0.00
Effective Radiated Power (watts)	6.71	4.63
Effective Radiated Power (dBW)	8.27	6.66
RX Sensitivity Level (uv)	0.71	1.26
RX Sensitivity Level (dBW)	-140.00	-135.00
RX Signal (uv)	9.70	21.70
RX Signal (dBW)	-117.25	-110.26
RX Field Strength (uv/m)	95.74	115.23
Fade Margin (dB)	22.75	24.74
Raleigh Service Probability (%)	99.470	99.665

Effect of Earth Curvature on Long Paths

This path requires greater mast height to offset the earth curvature experienced at such a distance (73km).
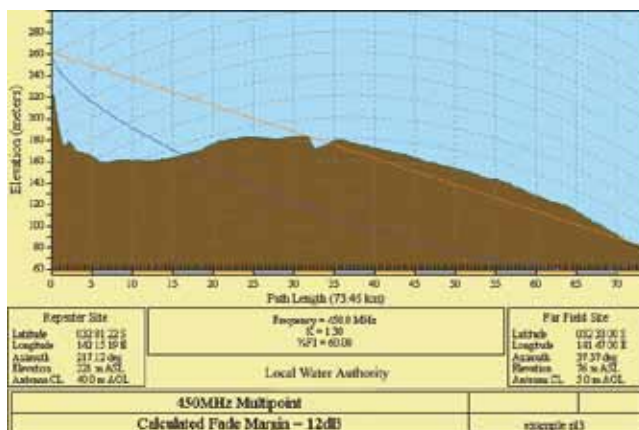
| longpath.pl3	Repeater Site	Far Field Site
Elevation (m)	221.26	75.58
Latitude	032 01 21.63 S	032 33 00.00 S
Longitude	142 15 19.26 E	141 47 00.00 E
Azimuth	217.12	37.37
Antenna Type	ANT450/6OM	ANT450/9AL
Antenna Height (m)	40.00	5.00
Antenna Gain (dBi)	8.15	11.15
Antenna Gain (dBd)	6.00	9.00
TX Line Type	LDF4-50	LDF4-50
TX Line Length (m)	40.00	5.00
	6.79	6.79
TX Line Loss (dB)	2.72	0.34
Connector Loss (dB)	2.00	2.00
Frequency (MHz)	450.00	
Path Length (km)	73.46	
Free Space Loss (dB)	122.85	
Diffraction Loss (dB)	22.94	
Net Path Loss (dB)	133.55	133.55
Radio Type Model	EB450	ER450
TX Power (watts)	5.00	1.00
TX Power (dBW)	6.99	0.00
Effective Radiated Power (watts)	6.72	4.64
Effective Radiated Power (dBW)	8.27	6.66
RX Sensitivity Level (uv)	0.71	1.26
RX Sensitivity Level (dBW)	-140.00	-135.00
RX Signal (uv)	1.49	3.32
RX Signal (dBW)	-133.55	-126.56
RX Field Strength (uv/m)	14.65	17.64
Fade Margin (dB)	6.45	8.44
Raleigh Service Probability (%)	79.735	86.656

There are basically two types of antennas – omni-directional and directional.

Omnidirectional antennas are designed to radiate signal in a 360 degrees segment around the antenna. Basic short range antennas such as folded dipoles and ground independent whips are used to radiate the signal in a "ball" shaped pattern. High gain omni antennas such as the "co-linear" compress the sphere of energy into the horizontal plane, providing a relatively flat "disc" shaped pattern which goes further because all of the energy is radiated in the horizontal plane.

Directional antennas are designed to concentrate the signal into "beam" of energy for transmission in a single direction (i.e. For point-to-point or remote to base applications).

Beamwidths vary according to the antenna type, and so can be selected to suit design requirements. The most common UHF directional antenna is the yagi, which offers useable beam widths of 30-50 degrees. Even higher "gain" is available using parabolic "dish" type antennas such as gridpacks.

Antenna Gain

Onmi directional
360 degree signal

Directional
Concentrated beam
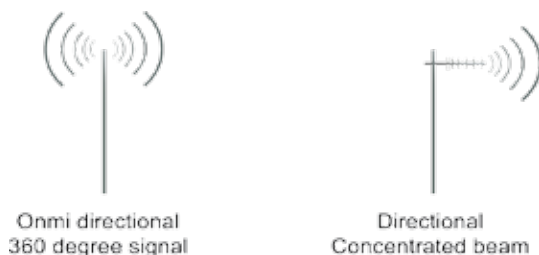
By compressing the transmission energy into a disc or beam, the antenna provides more energy (a stronger signal) in that direction, and thus is said to have a performance "gain" over a basic omni antenna. Gain is usually expressed in dBd, which is referenced to a standard folded dipole. Gain can also be expressed in dBi, which is referenced to a theoretical "isotropic" radiator. Either way, if you intend to send and receive signals from a single direction, there is advantage in using a directional antenna - both due to the increased signal in the wanted direction, and the relatively decreased signal in the unwanted direction (i.e. "Interference rejection" properties).

Tuning the Antenna

Many antennas are manufactured for use over a wide frequency range. Typical fixed use antennas such as folded dipoles and yagis are generally supplied with the quoted gain available over the entire specified band range, and do not require tuning. Co-linear antennas are normally built to a specific frequency specified when ordering.

With mobile "whip" type antennas, it is sometimes necessary to "tune" the antenna for the best performance on the required frequency. This is usually done by trimming an antenna element whilst measuring VSWR, or simply trimming to a manufacturer supplied chart showing length vs frequency. These antennas would normally be supplied with the tuning information provided.

Antenna Placement

When mounting the antenna, it is necessary to consider the following criteria:

The mounting structure will need to be solid enough to withstand additional loading on the antenna mount due to extreme wind, ice or snow (and in some cases, large birds).

For omni directional antennas, it is necessary to consider the effect of the mounting structure (tower mast or building) on the radiation pattern. Close in structures, particularly steel structures, can alter the radiation pattern of the antenna. Where possible, omni antennas should always be mounted on the top of the mast or pole to minimise this effect. If this is not possible, mount the antenna on a horizontal outrigger to get it at least 1-2m away from the structure. When mounting on buildings, a small mast or pole (2-4m) can significantly improve the radiation pattern by providing clearance from the building structure.

For directional antennas, it is generally only necessary to consider the structure in relation to the forward radiation pattern of the antenna, unless the structure is metallic, and of a solid nature. In this case it is also prudent to position the antenna as far away from the structure as is practical. With directional antennas, it is also necessary to ensure that the antenna cannot move in such a way that the directional beamwidth will be affected. For long yagi antennas, it is often necessary to install a fibreglass strut to stabilise the antenna under windy conditions.

Alignment of Directional Antennas

This is generally performed by altering the alignment of the antenna whilst measuring the received signal strength. If the signal is weak, it may be necessary to pre-align the antenna using a compass, GPS, or visual or map guidance in order to "find" the wanted signal. Yagi antennas have a number of lower gain "lobes" centred around the primary lobe. When aligning for best signal strength, it is important to scan the antenna through at least 90 degrees, to ensure that the centre (strongest) lobe is identified.

When aligning a directional antenna, avoid placing your hands or body in the vicinity of the radiating element or the forward beam pattern, as this will affect the performance of the antenna.

RF Feeders and Protection

The antenna is connected to the radio modem by way of an RF feeder. In choosing the feeder type, one must

compromise between the loss caused by the feeder, and the cost, flexibility, and bulk of lower loss feeders. To do this, it is often prudent to perform path analysis first, in order to determine how much "spare" signal can be allowed to be lost in the feeder. The feeder is also a critical part of the lightning protection system.

All elevated antennas may be exposed to induced or direct lightning strikes, and correct grounding of the feeder and mast are an essential part of this process. Gas discharge lightning arresters should also be fitted to all sites.

Note: All ETSI installations require the use of a lightning surge arrestor in order to meet EN60950. See Part A - Preface for lightning arrestor specifications.

Common Cable Types @ 450MHz	Loss per meter @ 450MHz	Loss per 10m
RG58C/U	0.4426dB	4.4dB
RG213/U	0.1639dB	1.6dB
FSJ1-50 (¼ superflex)	0.1475dB	1.5dB
LDF4-50 (1/2" heliax)	0.0525dB	0.52dB
LDF5-50 (7/8" heliax)	0.0262dB	0.3dB

Lightning Arrestor
(In Europe - Mandatory for R&TTE Directive)

Trio ER45e

Modem

Modulation Types

- The radio modem utilises a DSP to control the modulation of transmit signals and demodulation of received signals. This provides greater flexibility in the ability of the radio modem to support new modulation schemes whilst maintaining compatibility with existing modulation schemes.

- The type of modulation available for selection is dependent on the model of radio. Modulation types are sorted using the following criteria: Country of Approval (FCC, ETSI, ACA), Radio Channel Bandwidth (12.5kHz or 25kHz), Radio Mode (E Series, M Series or D Series) and over the air speed (2400bps, 4800bps, 9600bps, 19k2bps).

- Only modulation schemes suitable for the radio model in use are available for selection. Please consider the following notes when choosing a modulation.

- Country of Approval :

  FCC : for use in North America and other countries who use FCC approved radios.

  ACA : for use in Australia and New Zealand.

  ETSI : for use in Europe and other countries who use ETSI approved radios.Simplex, Half Duplex and Full Duplex (Full Duplex with ERFD450 option)

Power Supply and Environmental Considerations

General

When mounting the equipment, consideration should be given to the environmental aspects of the site. The cabinet should be positioned so that it is shaded from hot afternoon sun, or icy cold wind. Whilst the radios are designed for harsh temperature extremes, they will give a longer service life if operated in a more stable temperature environment. In an industrial environment, the radio modems should be isolated from excessive vibration, which can destroy electronic components, joints, and crystals.

The cabinet should provide full protection from moisture, dust, corrosive atmospheres, and residues from ants and small vermin (which can be corrosive or conductive). The radio modem will radiate heat from the in-built heatsink, and the higher the transmitter duty cycle, the more heat will be radiated from the heatsink. Ensure there is sufficient ventilation in the form of passive or forced air circulation to ensure that the radio is able to maintain quoted temperature limits.

Power Supply

CAUTION

The power supply should provide a clean, filtered DC source. The ER45e modem is designed and calibrated to operate from a 13.8VDC regulated supply, but will operate from 10-30 volts (filtered) DC, or 11-16 volts For an EB45e or EH45e.
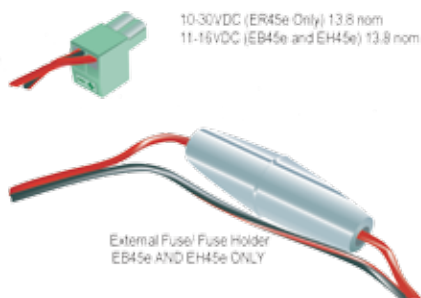

Range of 10 - 30V (13.8VDC Nominal). if the operating voltage is exceeded the E series Ethernet remote will self protect by opening its internal fuse.

The EB/EH45e models operate between 11-16VDC (13.8VDC Nominal).

Reverse Polarity Protection
The internal power supply circuitry of the ER45e has an in series diode. The fuse will not blow if reverse voltage is applied that is <= 30V DC.

The EB/EH45e models DO NOT have reverse polarity protection, if reverse polarity is applied the units fuse will blow.

10-30VDC (ER45e Only) 13.8 nom
11-16VDC (EB45e and EH45e) 13.8 nom

External Fuse/ Fuse Holder
EB45e AND EH45e ONLY

CAUTION

Caution: There is NO readily serviceable internal fuse for an EB45e or EH45e, and therefore they both MUST be externally fused with a fuse and fuse holder (EB45e: 5 amp fast-blow fuse, EB45e(20W): 8 amp fast blow fuse, EH45e: 1 amp slow blow fuse).

NOTE: The ER45e has a readily serviceable internal fuse.

The power supply must be able to supply sufficient current to provide clean filtered DC under the full current conditions of the radio modem (i.e. When transmitting full RF power). See Section L - Specifications for more details of the power supply requirements.

Solar Applications

In solar or battery-backed installations, a battery management unit should be fitted to cut off power to the radio when battery levels fall below the minimum voltage specification of the radio. In solar applications, a solar regulation unit MUST ALSO be fitted to ensure that the radio (and battery) is protected from excessive voltage under full sun conditions.

When calculating solar and battery capacity requirements, the constant current consumption will be approximately equal to the transmit current multiplied by the duty cycle of the transmitter, plus the receive current multiplied by the (remaining) duty cycle of the receiver.

The Tx/Rx duty cycle will be entirely dependent on the amount of data being transmitted by the radio modem, unless the device has been configured for continuous transmit, in which case the constant current consumption will be equal to the transmit current only (at 100% duty cycle).

Note: Operation below the minimum specified supply voltages could result in poor radio performance. If the supply voltage falls below 10Vdc the radio will shut down. Normal radio startup will not occur until 10Vdc is supplied.

CAUTION

Ensure that the chassis mounting plate, power supply (-) earth, RTU terminal device, and lightning arrester, are all securely earthed to a common ground point to which an earth stake is attached. Please pay particular attention to 24Vdc PLC systems using DC-DC converters to supply 13.8Vdc.

High Temperature Foldback

The ER45e will foldback the Transmit power by 6dBm if the internal temperature sensor detects +70 degrees Celsius or greater. If the remote is in foldback mode and the temperature is measured +67 degrees Celsius or lower, the power will return to its original state.

VSWR Sensing

The ER45e will foldback the Transmit power to +31dBm if a VSWR of 3:1 or greater is detected. If the remote is in foldback mode and a VSWR level of 2:1 or lower is taken, the power will return to its original state.

Physical Dimensions - Remote Data Radio - ER45e

Physical Dimensions - Mounting Cradle/Din Rail Mount

ER45e only (Optional)

Mounting Cradle

4.25mm
4 mounting Posts
For Din Rail Clip Option

32.85

87.50

36.00
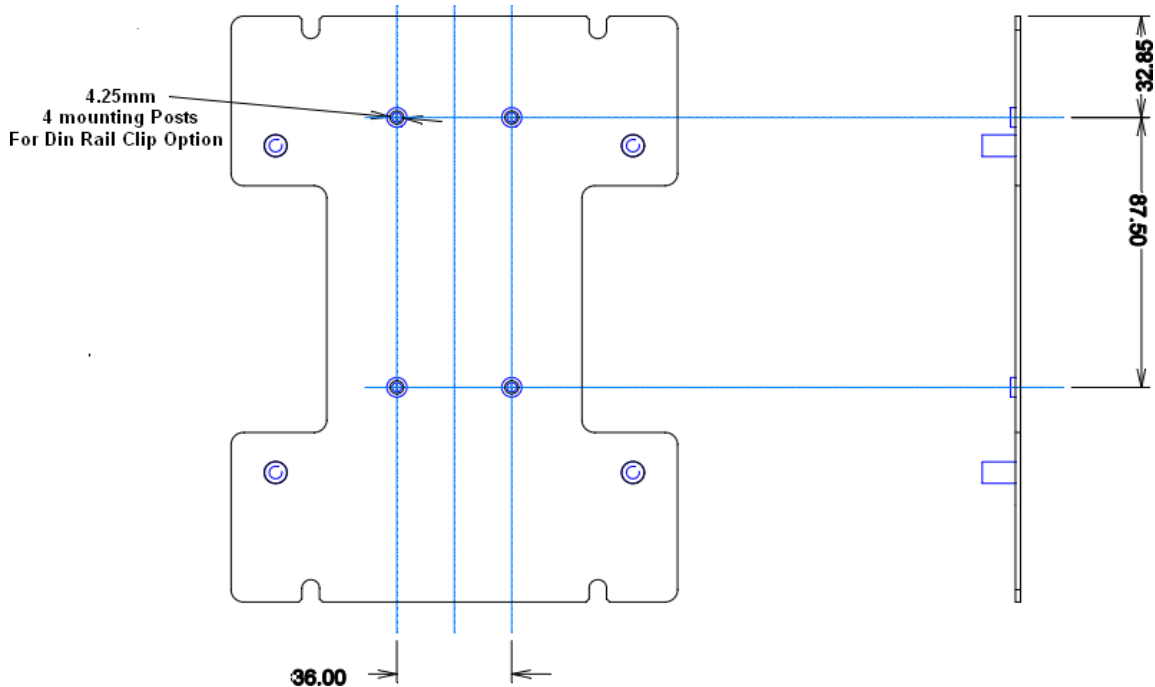
ER45e Mounting Cradle

The ER45e mounting cradle comes standard with the x4 mounting posts. If you want to purchase a new unit equip with the Din Rail mount, you can either request to have the units sent with the Din Rail mount already screwed onto the mounting cradle or have the Din Rail mount supplied separately along with x4 screws and x4 washers (screws: 3x8 Pan head, Washers: 3mm Spring washers). In the case of attaching the Din rail mounts to older radios, please ensure that you radio's mounting cradle has the x4 mounting posts.

Din Rail Mount (Optional)

130

3.5mm Din Rail

25

36
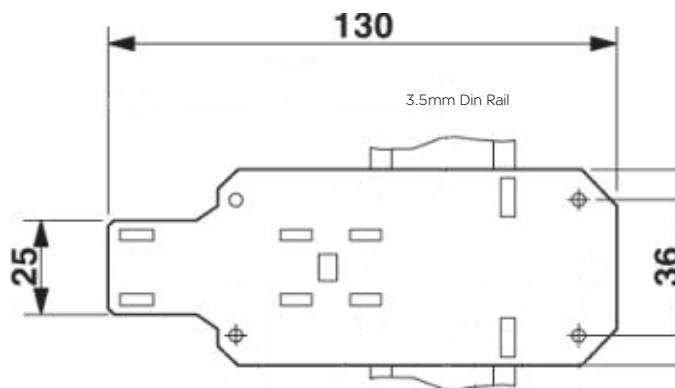
Din Rail Mount

The Din Rail Mount is an optional feature. The Mount is screwed onto the bottom of an ER45e Mounting Cradle giving the unit the ability to be simply 'clipped' and Locked onto 3.5mm Din Rail.

Hole drilling template

ER45e Mounting Cradle

The image below is a 1:1 scale of the mounting plate of an E-Series remote. This page can be printed off and used as a hole drilling template. Once you print the template out please measure it and compare your measurements to the specs printed to ensure scaling is correct.

90mm

182mm

ER45e Mounting Cradle
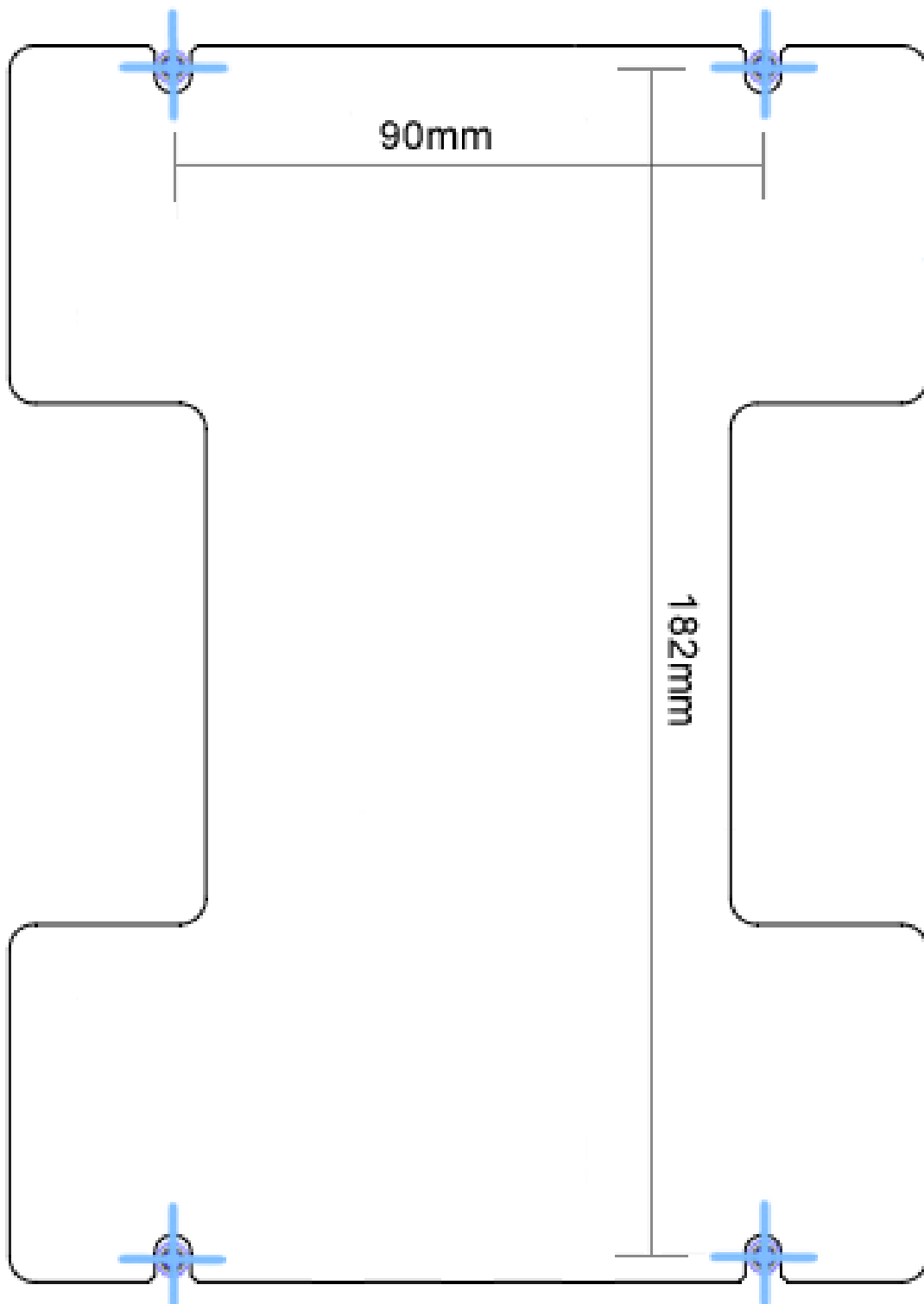
Physical Dimensions - Base Station - EB45e

424 mm

421 mm

*Note: 459mm for 20W version Base

482 mm

90 mm

Tx [ANT]   Rx

LAN   Data Port   System   Digital   Digital   DC Power
RS 232 DCE   Port   Inputs   Ouputs   11 - 16
1 2 3 4 5   1 2 3 4 5   + -

424 mm
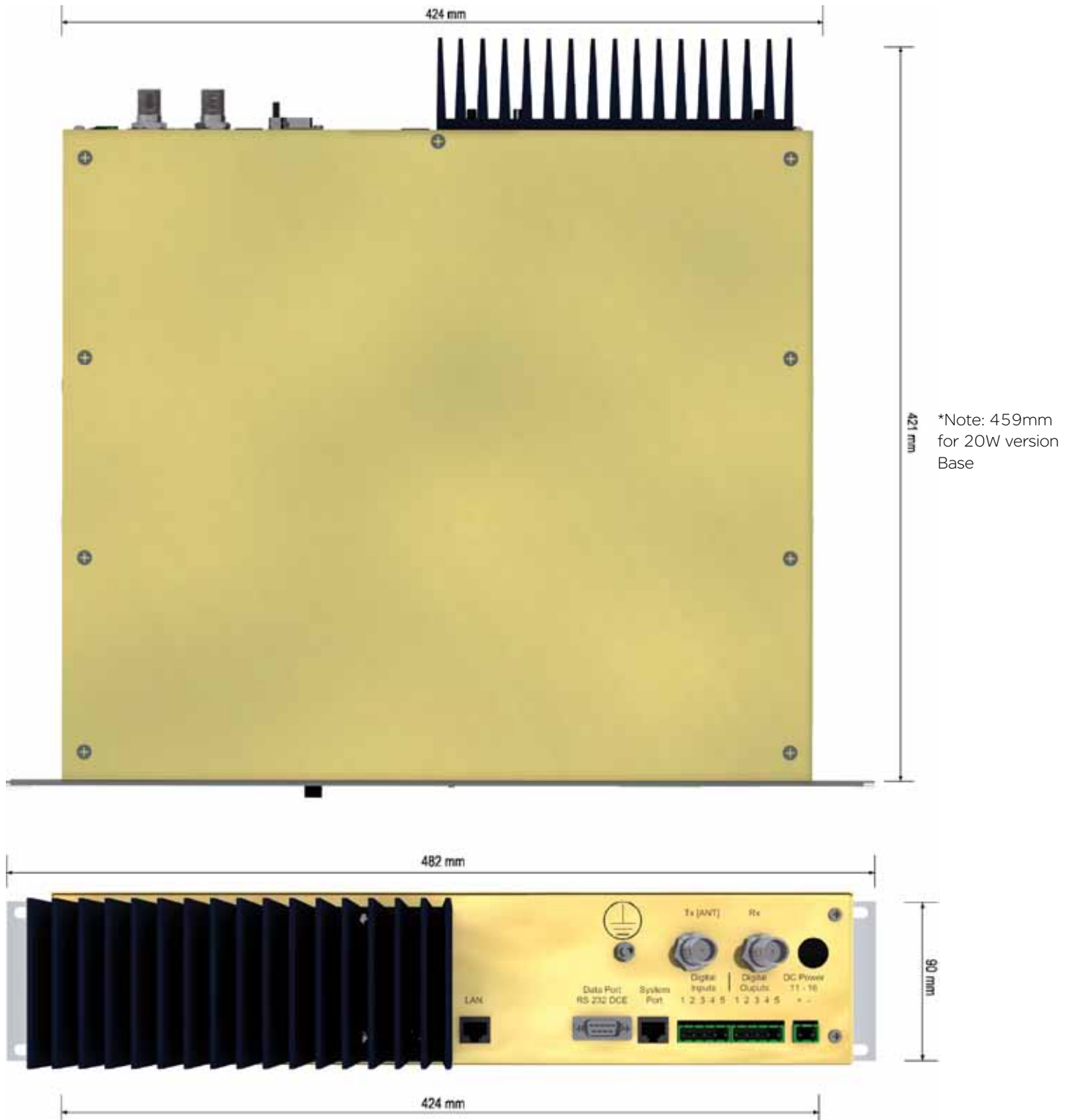
Physical Dimensions - Hot Standby Base - EH45e

424 mm

421 mm

*Note: 459mm for 20W version Base

482 mm

225 mm

90 mm

45 mm

90 mm

424 mm
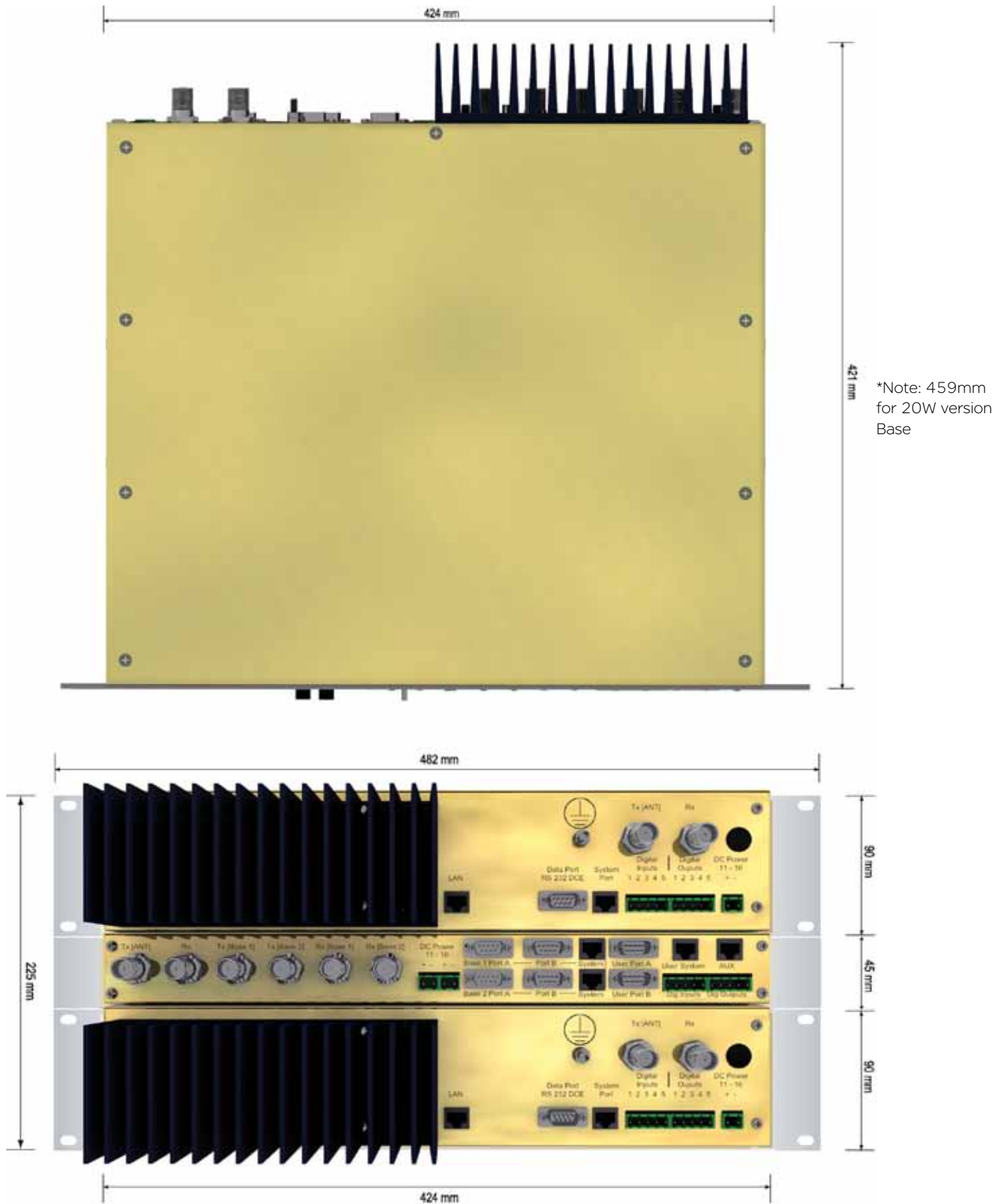
ER45e Quick Start Guide

Introduction

Welcome to the Quick Start Guide for the ER45e Ethernet Radio. This guide provides step-by-step instructions, with simple explanations to get you up-and-running.

ER45e Connections Layout

Typical Radio Setup

Mounting and Environmental Considerations

The ER45e radio comes complete with a mounting cradle and is attached to a panel or tray by means of screws or bolts, using the hole slots provided.

Note: In high power or high temperature applications, it is desirable to mount the radio with the heatsink uppermost to allow ventilation for the heatsink.

The radio should be mounted in a clean and dry location, protected from water, excessive dust, corrosive fumes, extremes of temperature and direct sunlight. Please allow sufficient passive or active ventilation to allow the radio modem's heatsink to operate efficiently.

CAUTION

Warning: Where an ER45e is to be operated between 45°C and 70°C ambient, it must be installed in a restricted access location to reduce the risk of somebody being burt.

Omni-Directional or Direction Yagi Antenna

Lightning Arrestor

Mains Supply

Ethernet E-Series

Ethernet Device (RTU/PLC) Connected to LAN port

Regulated Power Supply (110/220VAC to 13.8 VDC Nominal)

Laptop/PC running TView+ Diagnostics Connected to System Port

Connecting Antennas and RF Feeders

The RF antenna system should be installed in accordance with the manufacturers notes.

The RF connector used on the E Series radios are N Type female connectors. Always use good quality low loss feeder cable, selected according to the length of the cable run. Ensure all external connections are waterproofed using amalgamating tape.

Preset directional antennas in the required direction using a compass, GPS, or visual alignment and ensure correct polarisation (vertical or horizontal).

Lightning Arrestor
(In Europe - Mandatory
for R&TTE Directive)

Trio ER45e

Communications Ports

System Port – RJ45

The System Port (available front and rear on EB/EH45e) is a multi-function interface used for:

- Programming / Configuration of the radio
- Remote Diagnostics connections

To access these functions use the TView+ Cable assembly (RJ45 Cable and RJ45 to DB9 Adaptor).

The TView+ Cable is a standard CAT 5 RJ-45 (Male) to RJ-45 (Male) patch cable. It is intended for RS232 serial communications only and should not be connected directly into an Ethernet port of a PC. The Cable must be used in conjunction with the RJ-45 to DB9 Adaptor.

WARNING - EXPLOSION HAZARD
Do not disconnect while circuits are live
unless area is known to be non-hazardous

Data Port   System Port RS-232

RS 232 DCE

TView+ Adaptor Configuration:

| System Port	Description	DB9 Female
Pin 1	System port data out (RS232)	Pin 2
Pin 2	System port data in (RS232)	Pin 3
Pin 3	Factory Use Only - Do not connect	No Connection
Pin 4	Shutdown	No Connection
Pin 5	Programming Use Only (Grounded)	Pin 5
Pin 6	Factory Use Only - Do not connect	No Connection
Pin 7	Ground	Pin 5
Pin 8	External PTT	No Connection

Special user pinouts:

Shutdown (Pin 4) - Active low for power save function In order to put the radio into Shutdown mode, tie pin 4 to a digital output on a SCADAPack, RTU or similar device. When it is desired to turn the radio off, switching this digital output must connect the radio's pin 4 to ground. The (earth) ground of both devices would also need to be tied together as a common reference. (Pin 7 on the radio's System port) A 2 wire cable between SCADAPack and radio system port is all that's required, with an RJ-45 connector on the radio end. The Shutdown pin may be left floating for the radio to remain powered.

External PTT (Pin 8) - Provides a manual PTT override facility for enabling the transmitter. For testing this can be activated by connecting PTT (Pin 8) to Gnd (Pin 7).

Computer

RJ45 to DB-9 Adaptor

System Cable - RJ45

Cross Over cable (Trunking System Port to System Port)

Some circumstances require a user to trunk the system ports of two units using an RJ45 cross over cable. Follow the diagram below to create the cross over cable.
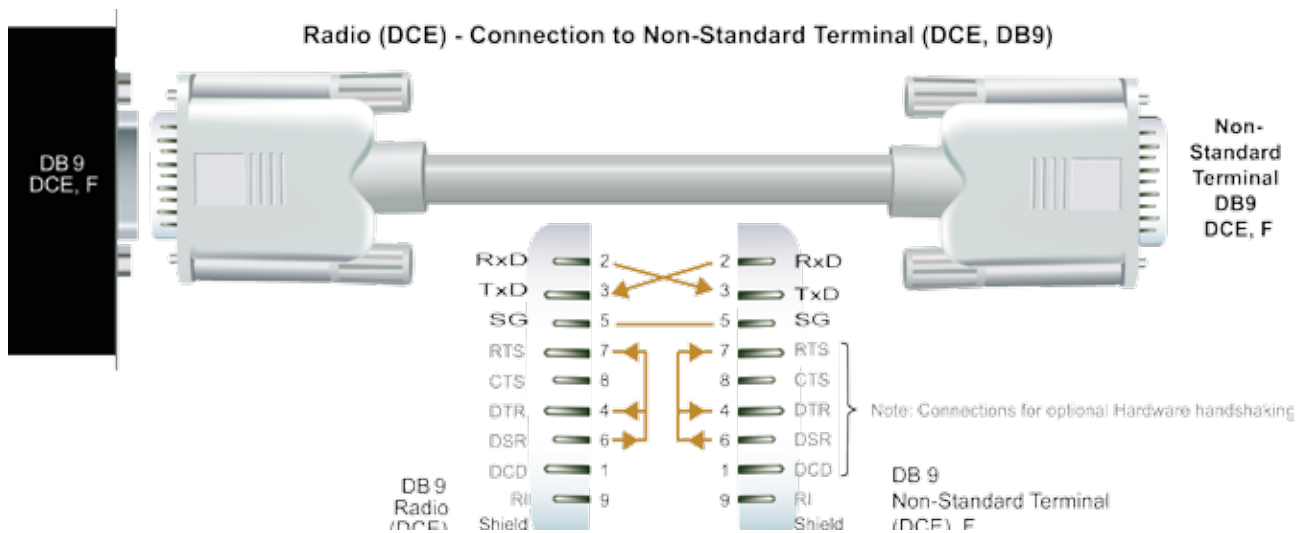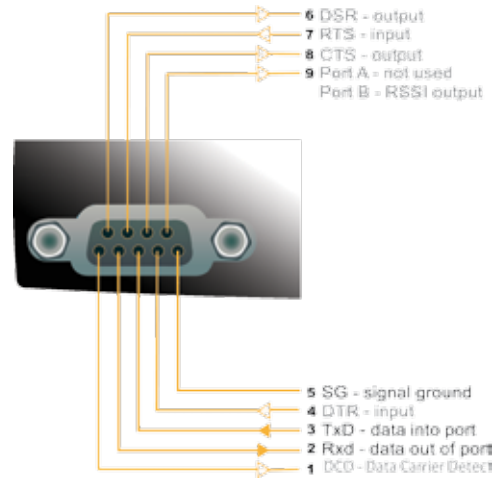
A   B

Connector A		Connector B
1		1
2	⨯	2
3 NC		NC 3
4 NC	NC	NC 4
5		5
6 NC		NC 6
7		7
8 NC		NC 8
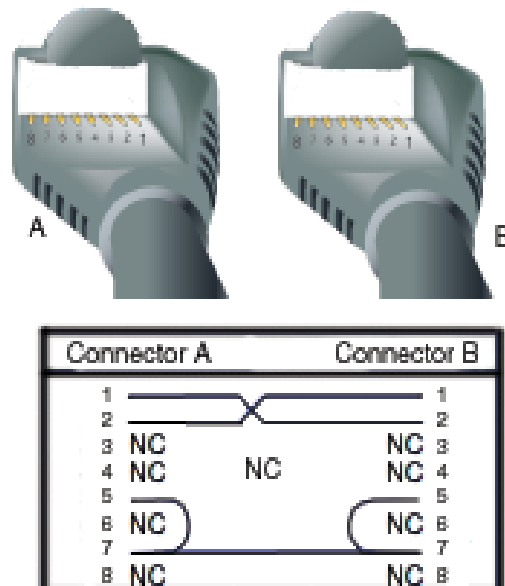
Data Port

The Data Port is wired as a RS232 DCE, configurable for no handshaking (3-wire) interface, or for hardware or software (X-on/X-off) flow control. In most systems flow control is not required, in which case only 3 wires need to be connected between the radio and the application device.

Typical pins used:

- Pin 2 (RxD) - data output from the radio modem,
- Pin 3 (TxD) - data input to the radio modem,
- Pin 5 (SG) - signal ground.

RS232 Connector Pin outs (DCE)
Data Port, Female DB9

6 DSR - output
7 RTS - input
8 CTS - output
9 Port A = not used
   Port B = RSSI output

5 SG - signal ground
4 DTR - input
3 TxD - data into port
2 Rxd - data out of port
1 DCD - Data Carrier Detect

Radio (DCE) - Connection to Non-Standard Terminal (DCE, DB9)

RxD	2	2	RxD
TxD	3	3	TxD
SG	5	5	SG
RTS	7	7	RTS
CTS	8	8	CTS
DTR	4	4	DTR
DSR	6	6	DSR
DCD	1	1	DCD
RI	9	9	RI
Shield			Shield

Note: Connections for optional Hardware handshaking

DB 9 Radio (DCE)

DB 9 Non-Standard Terminal (DCE), F

LAN Ethernet Port

The LAN port is a 10/100 Base-T compliant port using an RJ-45 connector. These ports support both TIA/EIA-568-A & B wiring as they have Auto MDI/MDIX Auto Sensing. This means you can use both straight-through and cross-over type CAT-5 or better patch cables. All RJ45 connectors must utilize mating plugs that include an integral locking tab.
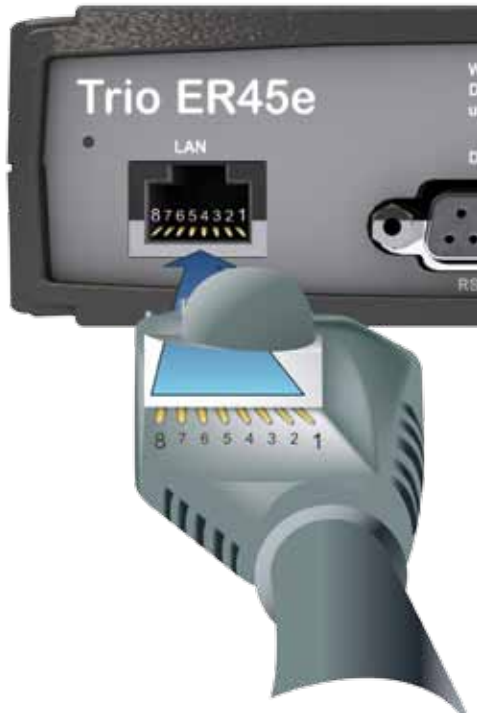
If termination of a cable is required, then the following wiring arrangement should be followed (Compliant with TIA/EIA-568-A).

Note: Maximum differential voltage : 5v, 50mA max through each differential pair.

Note: If 100-BaseT connection speed is required, CAT-6 Shielded cable should be used for installation to comply with ETSI EMC directives.

Performing a Factory Default

⚠️ Please read the following notes carefully. Configuration errors with Ethernet connections can be difficult to find and resolve. It is strongly recommended that you follow these guidelines.

IP Address and Factory Default Reset

The factory default IP address of an E **Series Ethernet radio** is 192.168.2.15. If you do not know the IP address of the E **Series Ethernet radio** you can either read the unit using the TView programmer or perform a factory default.

A factory reset will cause all previous configuration settings to be erased and returned to the factory default values. A factory default can be initiated by applying DC power to the radio (wait 45 seconds), depress the factory default switch using a paper clip or similar object and keep the switch depressed for 5 seconds until all five LEDs illuminate solid GREEN indicating the radio will return to the factory default settings. Please wait 45 seconds for the factory default reset process to complete.

Factory Default Button

Activating the Transmitter

In most systems, the transmitter by default is controlled automatically by the radio when it has data to transmit.

In some systems, such as full duplex point-to-point links or full duplex point-to-multipoint base stations, it is desirable to run the transmitter all the time (hot keyed).

Two mechanisms are provided to do this:

- The radio modem can be configured to transmit continuously whenever powered, or

- The radio modem can be configured to transmit whenever an external RTS signal (Pin 7) is applied to one (or either) user ports. (To simulate an external RTS input, loop pins 6 to 7).

To operate in these modes, the radio must be configured via the programming software.


CAUTION

Caution: When a radio is configured to transmit continuously, ensure an RF load is present BEFORE applying power to the unit, to prevent high levels of reverse power.

Power Supply Requirements

The ER45e Ethernet modem is designed and calibrated to operate from a filtered 13.8Vdc regulated supply, but will operate from a 10-30Vdc (11-16Vdc for EB45e & EH45e) range. See Section L - Specifications for more details on power supply requirements

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CAUTION

Caution: There is NO readily serviceable internal fuse for an EB45e or EH45e, and therefore they both MUST be externally fused with a fuse and fuse holder (EB45e: 5 amp fast-blow fuse, EB45e(20W): 8 amp fast blow fuse, Hot standby controller: 1 amp slow blow fuse).
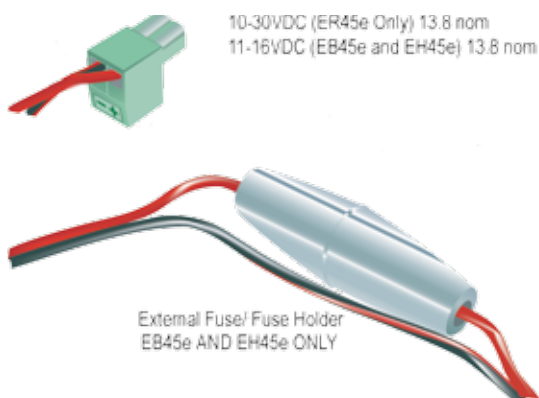
NOTE: The ER45e has a readily serviceable internal fuse Trio Part number: Part No. SM%FUSSQ5A) 5A Fast Acting – Littelfuse part numbers 0451005. MRL, 0453005.MR and 0448005.MR can be used. These fuses can be obtained from the following suppliers: Farnell P/N: 9922199RL, Digikey P/N: F2587CT-ND, Mouser P/N: 576-0451005.MRL

The ER45e is designed to self protect from permanent damage if the voltage exceeds 30VDC. The radio may need to be returned for service if this occurs. The ER45e remotes have an in Series Diode to protect against applied reverse polarity.

The radio modem can also be damaged if there is any potential difference between the chassis-ground, RS232 signal ground, power (-) input, or antenna coaxial shield. Before connecting any wiring, ensure all components are earthed to a common ground point.

Connect the antenna, RS 232 plug and LAN plug BEFORE applying power to the unit.

Lastly, before inserting the power plug, please re-check that the polarity and voltage on the power plug is correct using a multimeter.

TView+ Management Suite

Radio Configuration

This TView+ Management Suite allows a number of features including: Configuration (Local - serial, or Remote - over-the-air), Remote Diagnostics Facilities and Firmware Upgrades.

The configuration wizard can be used to provide Quick Start generic templates for the types of systems architecture you wish to employ.

Example: Local configuration session –

- 1 Attach the programming cable from the PC to the System Port of the radio

- 2 Launch TView+ & Select "Programmer"

- 3 Select "Read" the radio

- 4 Change the configuration as required

- 5 Select "Write" the parameters back to the radio

Refer to Part G – TView+ Management Suite for detailed operation of advanced features.
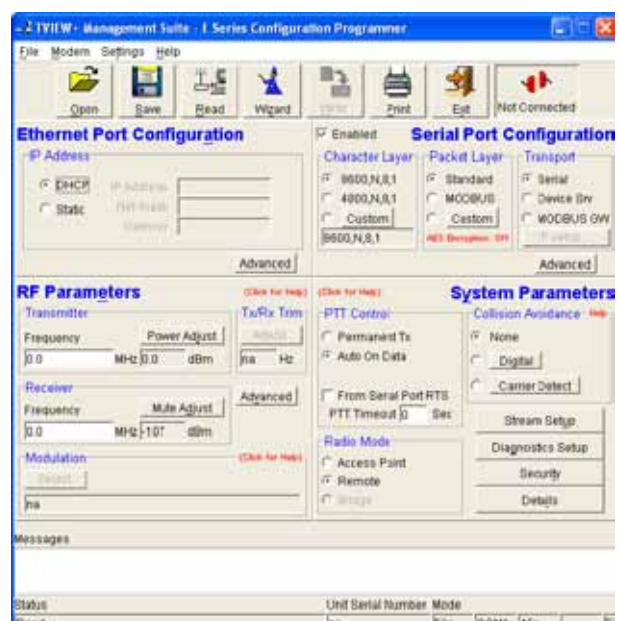
Optimising the Antenna for best RX signal

Once the unit is operational, it is important to optimise the antenna tuning.
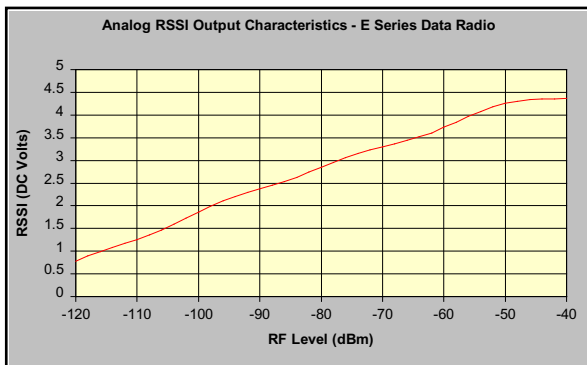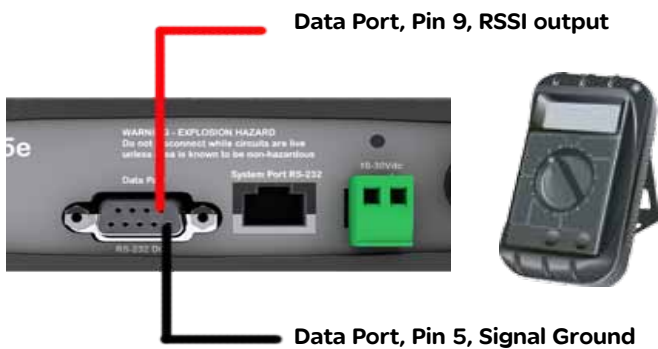
In the case of a directional antenna, it will be necessary to align the antenna for the best received signal.

This can be done by using the (0-5VDC) output on Pin 9 of the Data Port to indicate signal strength (RSSI). This voltage can be converted to dBm using the chart below.

Data Port, Pin 9, RSSI output

Data Port, Pin 5, Signal Ground

Please note that the RSSI table values are for indicative use only.

LED Indicators & Test Outputs

Radio is Powered

If all the LEDs are off, no power is reaching the radio modem.

Successful power-up is indicated by the "PWR" LED indicating a continuous (healthy) GREEN state. Note that this LED is turned RED when the transmitter is active.

Radio Errors

Internal radio management software monitors many aspects of the radio hardware. Under certain circumstances radio faults may prevent normal operation. In the event that these fault conditions occur, the radio will enter an ERROR state and this will be indicated by flashing ALL LEDs RED, then flashing a pattern of GREEN or AMBER LEDs. The pattern of GREEN LEDs represents the specific type of error that has occurred. All other patterns indicate serious hardware errors. Please record this pattern and return the result with the service return information.

Note (1): If external voltage is too high (>30Vdc) radio damage may occur. If the external voltage is too low (<10Vdc) the radio may not operate within specifications.

Note (2) and (3): If the radio receiver or transmitter frequencies are programmed outside the specified frequency ranges (model type dependent), then normal radio operation may not be possible. In this case, use TView+ to set the receiver and/or transmitter frequencies to be within the specified range. If this error occurs and the frequencies are within the specified frequency ranges (model type dependent), the radio will need to be returned for service.

Received Signal Indicator

The "RX/SYNC" LED is used to indicate the state of the receiver.

If the LED is off, no signal is being received.

A RED indication shows that an RF carrier is being received, but no data stream can be decoded. This will briefly happen at the very start of every valid received transmission or may indicate the presence of interference, or another user on the channel.

A continuous GREEN indication shows that the modem is locked and synchronised to the incoming signal, and has excellent Bit Error Rate (BER). Any losses of synchronisation (BER errors) are shown as a visible RED flicker of the LED.

Note: This might only be apparent on a PTMP slave when only receiving.

Data Flow "breakout" LEDs

There are also two LEDs to indicate data flow into and out of the two user ports.

Input data to be transmitted is shown as a RED flash, and received data to be output to the port is shown as a GREEN flash.

If data is alternately flowing in and out quickly, then the indicator appears orange.

It is possible to verify the operation of the radio modem using the indicators provided by the unit. The state of the transmitter and receiver, and data flow can be interpreted by the indicator LEDs (see below).

Note: LAN Port and Data Port's RxD and TxD will be Active on Data Flow

Full Duplex – PTP Master or Slave

Full Duplex – PTMP Master Tx

Half Duplex – PTMP Slave Rx

Half Duplex – Master or Slave (Tx)

Half Duplex – Master or Slave (Rx)

EB45e Quick Start Guide

Introduction

Welcome to the Quick Start Guide for the EB45e Base / Repeater Ethernet Radio. This guide provides step-by-step instructions, with simple explanations to get you up-and-running.

20W Power Amplifier option

The 20W power amplifier is primarily used for the purpose of overcoming Tx combiner losses. In such cases of a 20W power amplifier being required, an Rx preamp may also be required.

Note: 20W power amplifier options may not be available in all Countries. Please contact the factory to confirm availability.

Mounting and Environmental Considerations

The EB45e Base Station is housed in a 2RU 19" rack enclosure. The 4 mounting holes on the front panel should be used to secure the unit to the rack.

The radio should be mounted in a clean and dry location, protected from water, excessive dust, corrosive fumes, extremes of temperature and direct sunlight. Please allow sufficient passive or active ventilation to allow the radio modem's heatsink to operate efficiently.

All permanent connections are made at the rear of the unit. This includes: Power, Antenna, Communications Ports, Digital I/O and System Port. The front panel has an additional System Port connection point for easy access.

Power Supply and Protection

The power supply should provide a clean, filtered DC source. The EB45e Ethernet Radio is designed and calibrated to operate from a 13.8VDC regulated supply, but will operate from 11-16 volts (filtered) DC.

The power supply must be able to supply sufficient current to provide clean filtered DC under the full current conditions of the radio modem (i.e. When transmitting full RF power). See Section L - Specifications for more details of the power supply requirements.

Connecting Antennas and RF Feeders

See ER45e Quick Start Guide

CAUTION

Warning: Where an ER45e is to be operated between 45°C and 60°C ambient, it must be installed in a restricted access location to reduce the risk of somebody being burnt.

CAUTION

Caution: There is NO readily serviceable internal fuse for an EB45e or EH45e, and therefore they both MUST be externally fused with a fuse and fuse holder (EB45e: 5 amp fast-blow fuse, EB45e(20W): 8 amp fast blow fuse, hot standby controller: 1 amp slow blow fuse).

Full Duplex Considerations

The EB45e is designed for continuous full duplex transmission. An automatic thermostatically controlled fan will operate whenever the internal temperature exceeds 40 degrees Celsius and turn off again when the temperature goes below 35 degrees Celsius.

External Duplexer Considerations

The EB45e is normally supplied with separate Tx and Rx ports for connection to an external duplexing system.

Depending on the frequency band of operation and the Tx/Rx frequency split, internal band reject duplexers are available.

Communications Ports
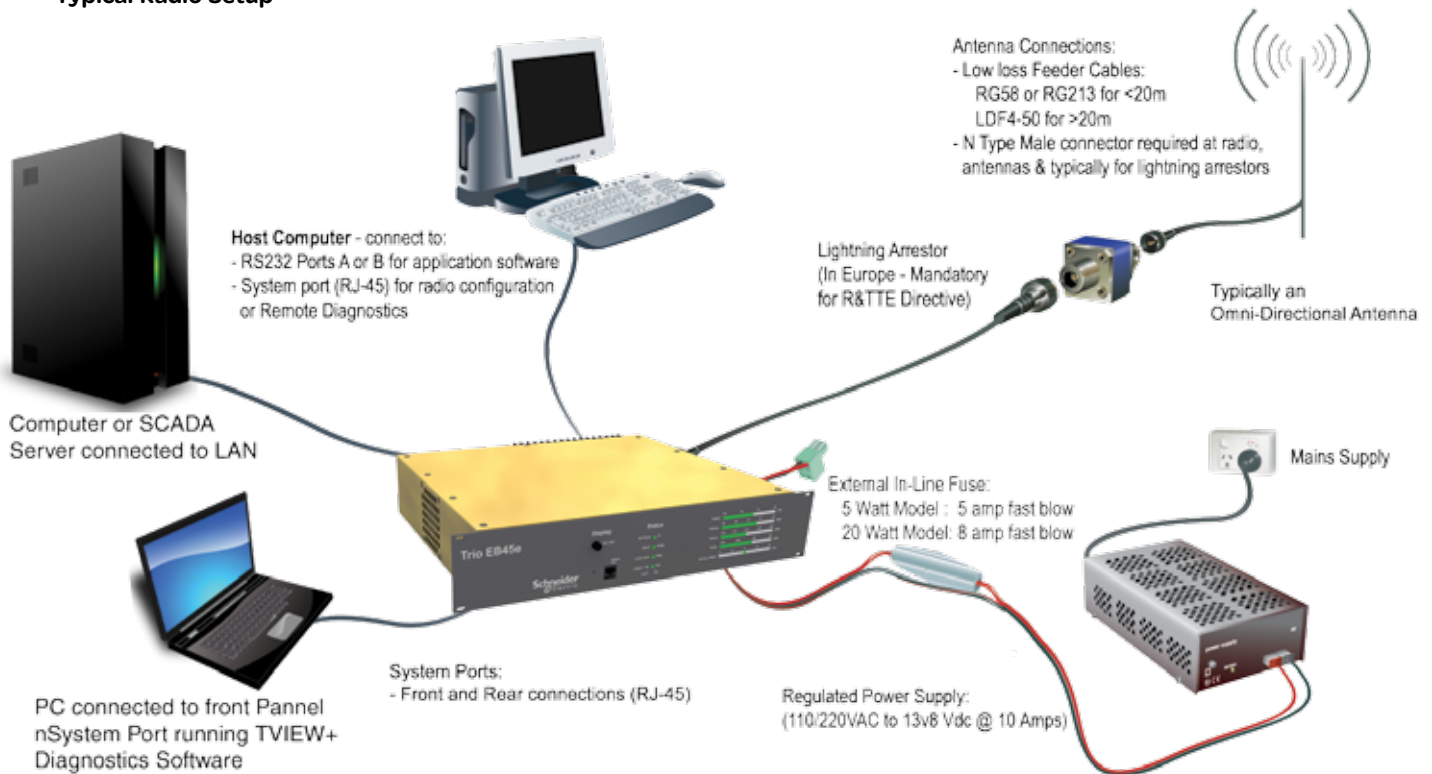
See ER45e Quick Start Guide Section

TView+ Management Suite – Radio Configuration

See ER45e Quick Start Guide Section

Optimising the Antenna for VSWR and best RX signal

See ER45e Quick Start Guide Section

Typical Radio Setup
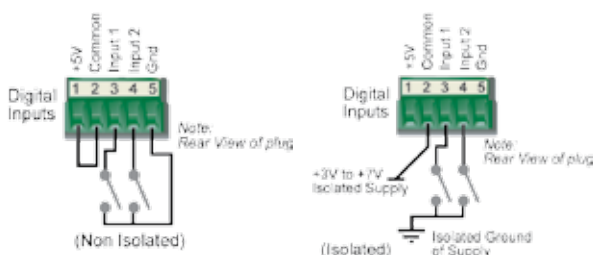

Digital Inputs and Outputs

The EB45e provides a facility for two channels of digital user inputs and outputs (Digital User I/O). Information on how to control and monitor this I/O using TView+ Diagnostics can be found in Part G - TView+ Management Suite - Remote Diagnostics & Network Controller.

All user I/O is optocoupled for isolation between the EB45e and uses equipment. When using the I/O facility the I/O electrical characteristics and ratings must be observed. Failure to observe these ratings may result in equipment damage.

Inputs

Two User Inputs are available. They have identical interface characteristics. Each input has an internal resistance of 470 Ohms. Some form of switching contact (i.e: switch, relay) is normally used to change the state of the input. Both an isolated and non-isolated input configuration is possible.

TView+ Diagnostics will recognise an input as being ON when the switch is closed. If the switch is open (or not connected) TView+ diagnostics will recognise the inputs as being OFF.

Outputs

Two User Outputs (Open Collector) are available. They have identical interface characteristics. The maximum current allowed through each output is 20mA. External resistors must be used keep the current below this value.

Each output has an internal resistance of 100 Ohms. Ohms law can be used to calculate the resistance required for a specific voltage (keeping the current below 20mA). Nominally 1K Ohm is used for a +13v8 supply and 330 Ohms for a +5v supply.

When the OUTPUT is OFF, V = Vs. No current will flow when output is off.

When the OUTPUT is ON, V = nominally 2.3 volts . Current is set by resistor.
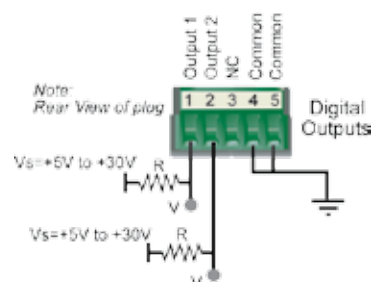
LED Indicators & Test outputs

Radio is Powered

If all the LEDs are off, no power is reaching the radio modem.

Successful power-up is indicated by the "PWR" LED

Indicating a continuous (healthy) GREEN state. Note that this LED is turned RED when the transmitter is active.

Hardware Error

hardware errors are indicated on the status LEDs by all LEDs flashing RED at a rate of 1Hz. This indicates internal communications to the exciter has been lost. Contact Schneider Electric Support to confirm course of action. The base station may need to be returned to Schneider Electric for repair.

Received Signal Indicator

The "RX/SYNC" LED indicates the state of the receiver.

If the LED is off, no signal is being received.

A RED indication shows that an RF carrier is being received, but no data stream can be decoded. This will briefly happen at the very start of every valid received transmission or may indicate the presence of interference, or another user on the channel.

A continuous GREEN indication shows that the modem is locked and synchronised to the incoming signal, and has excellent Bit Error Rate (BER). Any losses of synchronisation (BER errors) are shown as a visible RED flicker of the LED.

Note: This might only be apparent on a PTMP slave when
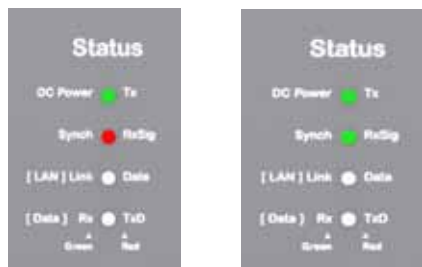
only receiving.

Data Flow "breakout" LED

There are also two LEDs to indicate data flow into and out of the two user ports.

Input data to be transmitted is shown as a RED flash, and received data to be output to the port is shown as a GREEN flash.

If data is alternately flowing in and out quickly, then the indicator appears Orange.

LAN activity LED

The "Active/Link" LED is used to indicate the state of the LAN port. If the LED is OFF, there is no activity at all on the LAN port. A GREEN indication shows an established Ethernet link. The LED will flash AMBER to indicate Ethernet data transmission is occurring.

Bar Graph Indicators

The bar graph indicators on the front panel provide variable information regarding the performance of the Base Station. To enable / disable the bar graph display depress the Display ON / OFF button. The display will turn off automatically after 5 minutes.

DC Supply:

Indicates the supply input voltage at the exciter module. Typically 13.8Vdc. Indication: <10Vdc no LED's on, 10-10.9VDC LED's RED, 11-15.6Vdc All LED's GREEN, >=15.7Vdc last LED RED.

Tx Power:

Indicates forward RF power output as measured at the TX antenna port. Typically +37dBm or +43dBm for a 20W version. Indication: <20dBm no LED's on, 20-40.6dBm (11.5W) LED's GREEN, >=40.7dBm last LED RED.

Tx Drive:

Indicates exciter drive level. Typically +20dBm. Indication: <10dBm no LED's on, 10.0-25.9dBm LED's GREEN, >=26.0dBm last LED RED.

Rx Sig:

Indicates receive signal strength. Typically -85 to -65dBm. Indication: <-120dBm no LED's on, -120 to -110.1dBm LED's RED, >=-110dBm LED's GREEN.

RxFreq. Offset:

Indicates offset of receiver AFC - useful in determining frequency drift. Typically 0kHz. Indication: Single GREEN LED to indicate current value, <-3.6kHz or >+3.6kHz LED is RED. No signal, all LED's OFF.
Note: 5 second peak hold circuitry.

Test Mode

The Bar Graph indicators have a Test Mode, which cycles all LED's for correct operation (before returning to their normal operation). To activate this mode, simply depress the ON / OFF button while applying power to the unit.

Factory Default

To Perform a factory default on an EB45e you must:

- Depress the Display ON/OFF button until the LED indicators begin to flash. (Approx 15 seconds)

- Release the Display ON/OFF button for at least 1 Second.

- Depress the Display ON/OFF button again unit the LED indicators stop flashing. (Approx 15 seconds)

EH45e Quick Start Guide

Introduction

Welcome to the Quick Start Guide for the EH45e Hot Standby Base / Repeater Station. This section provides additional step-by-step instructions to install, commission and operate the EH45e Hot Standby Base Station. This document should be read in conjunction with the EB45e Base Station Quick Start Guide.

The EH45e is a fully redundant, hot standby digital Ethernet radio base / repeater station providing automatic changeover facilities.

The EH45e is designed as a modular solution, comprising 2 identical EB45e base station units (standard) linked to a central, fail-safe monitoring and changeover controller (Hot Standby Controller). Either base station may be taken out for maintenance without the need for any system down time. The automatic changeover is triggered by out of tolerance (alarm) conditions based on either RF and/or user data throughput parameters.

- Individual and identical base stations with separate control logic changeover panel

- Modules are hot swapable without user downtime

- Flexible antenna options – single, separate Tx & Rx, two Tx and two Rx

- Both on-line and off-line units monitored regardless of active status

- Also refer to the common Features and Benefits list of the E Series Data Radio

Operational Description

Base / Repeater Unit

Base / Repeater Unit

Hot Standby Controller Unit

Rear View

The Hot Standby Controller (HSC) unit is a 1RU rack mounted module that interfaces to two physically separate base stations (each 2RU rack mounted modules) via a number of RF and data cables.

Both base stations are operating simultaneously and both units are constantly receiving signals, however only data from one base station, the "online" base station is directed to the user equipment. The online base station is the only base station transmitting at any time. The Hot Standby Controller has the following functions:

- Diplex the transmit and receive paths (Assuming internal duplexer fitted), TX Only.

- Amplify and split the incoming signal two ways so both base stations receive at once.

- Monitor status reports from both base stations to identify faults and swap over the online base station if required.

- Switch the antenna via internal coaxial relay duplexer to the online base station transmitter and inhibit the offline base station from transmitting.

- Switch the User port and the Data port through to the online base station.

An optocoupler based switch in the base station controller directs data to and from ports A and B on the rear panel directly to the Data Port on the on-line base station without any involvement from the Hot Standby controller microcontrollers (apart from selecting the on-line base). This provides protection of the system from failure of the microcontroller.

As well as the Data Port, each base has a system port. The system port of each base station is interfaced to the microcontroller on the Hot Standby controller. This allows the microcontroller in charge of selecting the base station to receive diagnostic messages from each base station to decide their health.

The base station has it's own system port on the rear panel and this is interfaced to the Hot Standby Controller Module. The HSC will route diagnostics at the rear panel system port to and from the system ports of the base stations.

Please note:

The base station front panel system port has priority over the rear panel port, which is used for communication between the base station and the Hot Standby Controller. This is to permit service personnel to reconfigure the base station module without disconnection from the Hot Standby Controller. It should be noted however, that when the front panel port is accessed, a changeover event will occur due to lost communications with the Hot Standby Controller.

Ethernet Port Link monitoring

The Hot Standby arrangement can monitor two devices on the non-wireless side of the base stations. for more information on Ethernet Link monitoriing, please refer to part D - Features.

Mounting and Environmental Considerations

The EH45e Hot Standby Base Station is housed as a 5RU 19" rack mounted set, encompassing 2 x 2RU Base Station units and 1 x 1RU Hot Standby Controller unit. The mounting holes on the front panels should be used to secure the units to the rack.

The unit should be mounted in a clean and dry location, protected from water, excessive dust, corrosive fumes, extremes of temperature and direct sunlight. Please allow sufficient passive or active ventilation to allow the radio modem's heatsink to operate efficiently.

All permanent connections are made at the rear of the unit. This includes: Power, Antenna, Communications Ports, Digital I/O and System Port. The front panel has an additional System Port connection point for easy access.

The Base Station front panel system ports must not be used while in this configuration.

Communications Ports

The Data Port and System Port of each Base Station connect directly to the Hot Standby Controller units corresponding ports with the cables provided. Ensure all clamping screws on the Data Port cables are firmly secured and the System Port cables are clipped in correctly. See figure below for further details.

Note: Only the front or rear User System Port can be used at any one time on the Hot Standby Controller.

The Hot Standby Controller units B Data Port connects directly to your application device and the System Port connects directly to your local PC. See EH45e Quick Start Guide Section for further details.
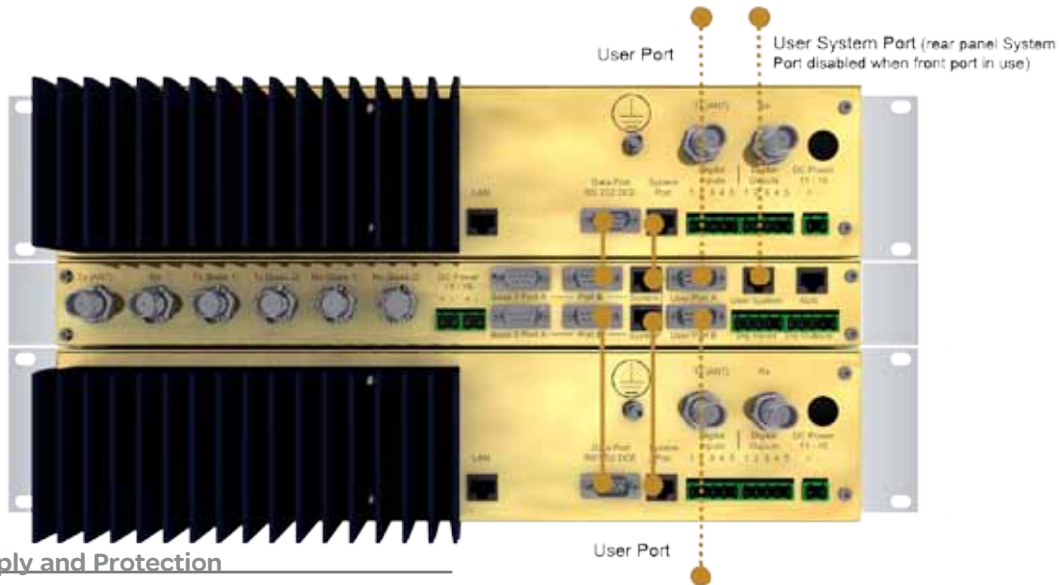
Power Supply and Protection

The EH45e has facilities for dual power supplies to provide for a redundant system. A separate power supply should be used for each of the Base Station units. The Hot Standby Controller unit has connections for dual power supplies and it is recommended that the power supplies from each of the Base Stations also be used to power the Hot Standby Controller unit. See Figure below for further details. See ER45e Quick Start Guide Section for detailed wiring information.
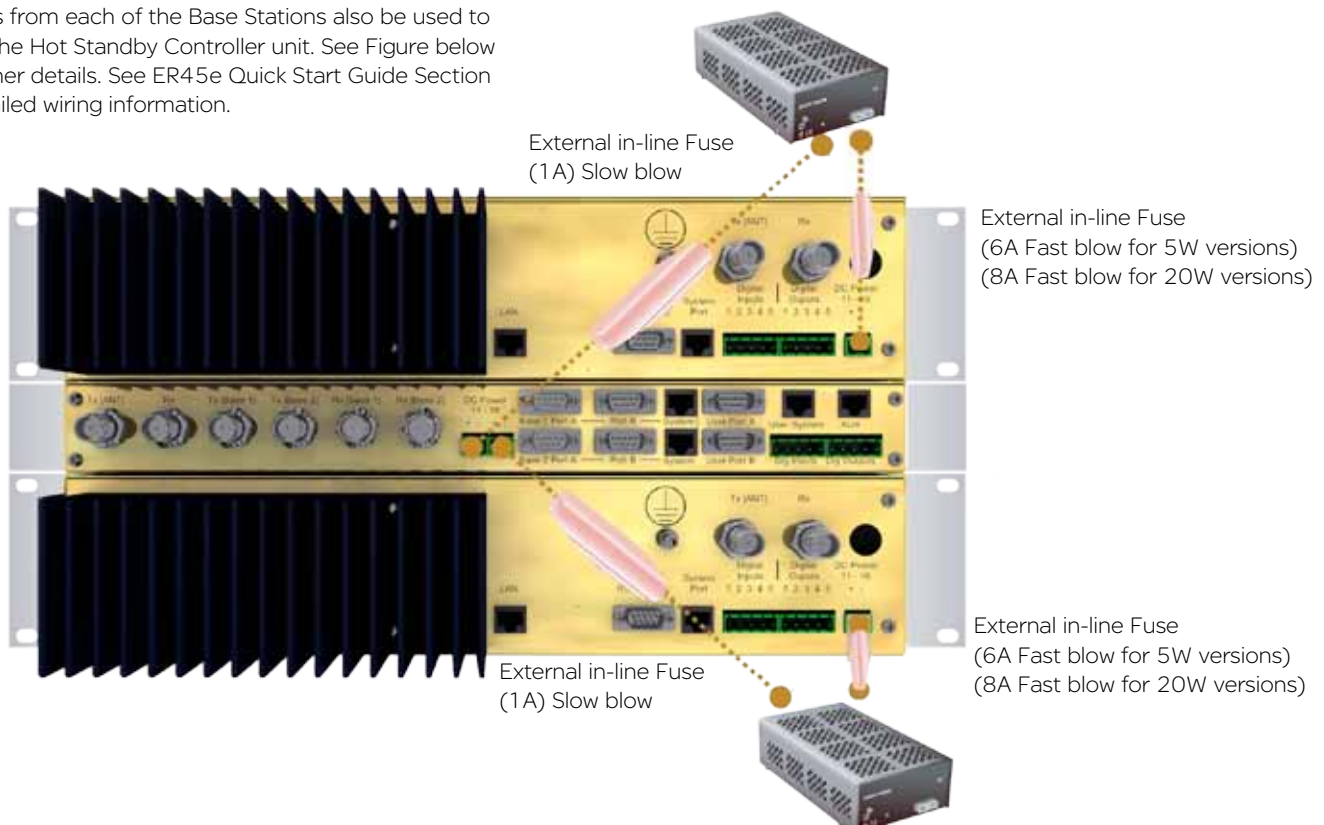
Connecting Antennas and RF Feeders

There are 3 primary antenna connection options. All connectors used are standard N Type sockets. See figures below for further details.

See ER45e Quick Start Guide for detailed wiring information.

Option 1: Individual Tx & Rx ports for connection to:
a) Separate dual antennas (Tx & Rx) working
b) External duplexer

Option 2: Single Antenna working (internal band reject duplexer). Use Tx [ANT] connection of Controller module.

Option 3: Dual redundant antennas (Tx & Rx) working.
Note: this option does not use the RF connections between the Base stations and Controller modules. No Rx low noise amplifier. Individual Tx & Rx ports for connection to:
a) Separate dual antennas (Tx & Rx) working
b) External duplexer

Omnidirectional or Directional Yagi Antenna

Lightning Arrestor
(In Europe - Mandatory for R&TTE Directive)

Front Panel Operation

Switches

Select Switch

The 3 position switch (1 / Auto / 2) on the front panel provides the following functionality:

- Position 1: base station 1 is forced into operation

- Position Auto: changeover hardware will select the online base station

- Position 2: base station 2 is forced into operation

The select switch is also used to identify the target base station for configuration programming.

Adjacent to the select switch are two LEDs: These LEDs indicate the current active base station.

Select LEDs

- Green - Auto Mode

- Red - Remote Force

- Amber - Local Force

2 Green Firmware Download

2 Amber Test Mode

2 Red Fatal Error - refer User Manual

Reset Switch

This is a momentary close switch which when depressed will reset all LED alarm indications.

System Port

There are two system port connection points, one on the rear panel and one on the front panel. Both have the same functionality and can be used for local diagnostics, firmware front panel downloads and hot standby controller testing. To access the system port use the diagnostic/programming cable supplied.

Note: When connection is made to front panel system rear system port is disabled.

Alarm Status LEDs

There are 10 alarm LEDs on the front panel, five for base 1 and five for base 2. These LEDs provide a general indication of base station status. More detailed base station status information is available by using the diagnostic utility software.

The indicated alarms for each base station are:

Freq.	=>	Frequency Error
RxSig	=>	Receive Signal (RF) Error
Data	=>	Receive Data Error
TxPower	=>	Transmit Power (RF) Error
Supply	=>	DC Voltage Error

The status of each alarm is represented as follows:

OFF	=>	Unknown
Green	=>	No Error
Red	=>	Current (active) Error condition
Amber	=>	Recovered Error condition

Any active or recovered error LEDs will turn to green after the reset alarms switch has been pushed or remotely reset.

Base Station LED Error indicators in Hot standby arrangement

Ethernet Link monitoring LED error indication: This error is indicated by the four Status LEDs on the front panel of the base station all illuminating solid red for 5 seconds, then all the status LEDs on the front panel turning off for 5 seconds. This slow flashing will continue until the base in this error mode can successfully ping it's configured primary or secondary Ethernet link IP address.

Part F – Quick Reference Guide

SNMP

As of Ethernet E-Series Firmware version 5.5.0, SNMP with notifications is supported.

The Ethernet E-Series SNMP Interface supports:

- Supports RFC1213 (Unit name, Unit Location, Firmware, Uptime, etc) Note: Details about RFC1213 and the SNMP parameters included in this standard can be found in this link: http://www.ietf.org/rfc/rfc1213.txt

- Supports Radio and Ethernet Diagnostics.

- SNMP V1 & V2c

- SNMP notifications which include traps and informs

Notifications

Ethernet E-Series notifications are unsolicited SNMP messages designed to inform a user of a change in state within the Ethernet E-Series that may cause an issue on the radio system. The Ethernet E-series supports two types of notifications:

- **Traps:** Traps are low bandwidth consuming UDP notifications that have no requirement for a response. If the message is lost along the way to the destination IP address, the message will be lost.

- **Informs:** Informs are essentially traps that requires a response from the destination IP address once an inform has been sent. This gives informs more reliability getting to a destination as the Ethernet E-Series will support retries and timeout periods.

MIB Files

Distributed with the Ethernet E-Series firmware are three MIB files which provide structure definitions for the SNMP objects. The MIBs are suitable for importing into most common SNMP browsers including Castle Rock. Definitions for each SNMP object are noted as comments in the MIB files. Only a summary of these objects are noted in this user manual.

Status Levels for SNMP Parameters

There are a maximum of three status levels for the Ethernet E-Series SNMP parameters. Each one is also represented with a status number. The status levels and corresponding numbers are as follows:

- **Normal – 1:** The 'Normal' status level will be displayed within a notification when a parameter has recovered from an alarm state. For example: the input voltage to the Ethernet E-Series drops below 9VDC, this will cause a 'critical alarm' notification to be sent. Once the input voltage has recovered back to normal operating voltage, a 'Normal' status notification will be sent to inform a user that the critical error has recovered.

- **User alarm – 2:** A 'User alarm' notification will be sent when a parameter within the Ethernet E-Series falls out-side of the user defined alarm limits.

- **Critical alarm – 3:** A 'Critical alarm' notification will be sent when a parameter within the Ethernet E-Series falls out-side of the unit's hardware specification.

ER45e MIB - Summary of SNMP Parameters Supported

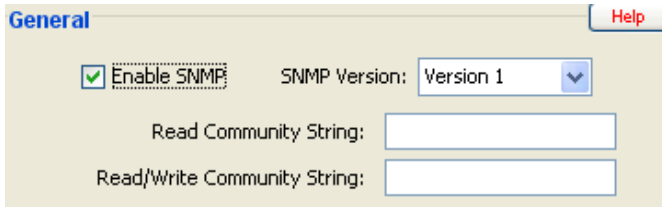| Object name	Object description
General Group:	
serialNumber	Serial number of the E-Series
modelNumber	Model number of the E-Series
hardwareRevision	Hardware revision of the E-Series
radioType	The type of radio module in the E-Series
firmwareRevision	The firmware revision of the E-Series
date	The date as reported by the E-Series
time	The time as reported by the E-Series
utcTimeOffset	Time offset from UTC for the E-Series local time zone
upTime	The uptime of the E-Series
primaryNtpServer	Primary Network Time Protocol (NTP) domain name
cpuLoad	Average CPU utilisation (%) for the past 15 minutes
supplyVoltage	Supply Voltage of the E-Series in mV
temperatureC	The internal temperature of the E-Series (degrees C)
temperatureF	The internal temperature of the E-Series (degrees F)
ipAddress	The IP address of the E-Series
Radio Group:	
radioMode	The operating mode of the radio
radioReceivedPackets	Number of packets received from the radio link
radioTrasnmittedPackets	Number of packets transmitted over the radio link
radioForwardPowerTable	Table of radio forward powers
radioReversePowerTable	Table of radio Reverse powers
radioVswrTable	Table of radio VSWR's
radioRssiTable	Table of RSSI values
radioDataRate	The over-the-air data rate of the E-Series
modulationRecord	The modulation record of the E-Series
txFrequency	Radio's transmit frequency (Hz)
rxFrequency	Radio's receive frequency (Hz)
muteThreshold	Radio's mute threshold (dBm)
syncLostCount	Lost synchronization count
rxSignalLostCount	Receive signal lost count
rxGoodFrameCount	Good frames received
rxGoodByteCount	Good bytes received
rxBadFrameCount	Bad frames received
rxAverageGoodFrameSize	Average received good frame size
rxAverageFrameRate	Average receive frame rate
rxChannelOccupancy	Receive channel occupancy
rxSlidingChannelOccupancy	Sliding channel occupancy
rxChannelUtilisation	Receive channel utilisation
txByteCount	Received bytes count
txFrameCount	Transmit frame count
txAverageFrameSize	Transmit average frame size
txAverageFrameRate	Transmit average frame rate
txChannelUtilisation	Transmit channel utilisation
radioFrequencyError	Radio frequency error (Hz)

Security Group:	
snmpVersion	SNMP version in use
encryptionEnabled	Encryption status
LAN Group:	
lan1LinkStatus	LAN1 link status
lan1LinkSpeed	LAN1 link speed
lan1LinkMode	LAN1 link mode
Error Group:	
rxPllLocked	Received PLL lock status
radioVswrErrorTable	Table of Vswr alarms
externalSupplyVoltageErrorState	External supply voltage Normal = Operating within normal conditions, UserAlarm = Operating outside of user specified limits, CriticalAlarm = Operating outside of factory specified operating limits.
temperatureErrorState	Internal temperature Normal = Operating within normal conditions, UserAlarm = Operating outside of user specified limits, CriticalAlarm = Operating outside of factory specified operating limits.
radioRssiErrorTable	Table of radio RSSI alarm states
radioTxPowerErrorTable	Table of radio tx power alarms
globalErrorState	Global Monitored Alarm Normal = All monitored parameters are operating within normal conditions, UserAlarm = One or more monitored parameters are operating outside of user specified limits, CriticalAlarm = One or more monitored parameters are operating outside of factory specified operating limits.
syncErrorState	Sync status alarm Normal = Radio currently synchronized, CriticalAlarm = Radio not currently synchronized.
txPllLocked	Transmit PLL lock status
radioFrequencyErrorState	Frequency error state. Normal = Operating within normal conditions, UserAlarm = Receive frequency error out of user specified limits.
Base Station Group:	
frontPanelFirmwareVersion	Front-panel firmware version
digitalInput1	Digital input 1 value
digitalOutput1	Digital output 1 value
digitalInput2	Digital input 2 value
digitalOutput2	Digital output 2 value
baseOnline	Base station is online status
baseForceOnline	Force base station off or online
Notification Group:	
notificationPllLock	PLLs Locked
notificationVswr	High VSWR
notificationTemperature	Temperature
notificationSupplyVoltage	Supply voltage notification
notificationRssi	RSSI out of range
notificationTxPower	Tx power out of range
notificationSync	Sync status changed
notificationIpAddressChanged	The IP address has been changed
notificationGlobalErrorChanged	The global error status has changed
notificationDiagnostic	Periodic diagnostic information
notificationFrequencyErrorChanged	The frequency error status has changed
notificationDigitalInput1Notification	Base station digital input 1 state changed notification
notificationDigitalInput2Notification	Base station digital input 2 state changed notification

EH45e MIB – Summary of SNMP Parameters Supported

Object name	Object description
General Group:	
hscSerialNumber	Serial number of the hot standby controller
hscFirmwareVersion	Firmware version of the hot standby controller
hscBaseSelectionMode	Selected base station
hscOnlineBase	Online base station.
hscChangeOverEventCounter	Change over event counter of the hot standby controller
Radio Group:	
base1FrequencyErrorState	Base 1 frequency error state
base1RxSignalErrorState	Base 1 receive signal error state
base1DataErrorState	Base 1 data error state
base1TxPowerErrorState	Base 1 transmit power error state
base1DcPowerErrorState	Base 1 dc power error state
base2FrequencyErrorState	Base 2 frequency error state
base2RxSignalErrorState	Base 2 receive signal error state
base2DataErrorState	Base 2 data error state
base2TxPowerErrorState	Base 2 transmit power error state
base2DcPowerErrorState	Base 2 dc power error state
resetAlarmOnHotStandby	Reset alarms on hot standby controller. Reset change over counter.
Notification Group:	
notificationBaseChangeOver	Base station changeover notification
notificationBase1FrequencyErrorChanged	Base station 1 frequency error state changed notification
notificationBase1RxSigErrorChanged	Base station 1 receive signal error state changed notification
notificationBase1DataErrorChanged	Base station 1 data error state changed notification
notificationBase1TxPowerErrorChanged	Base station 1 transmit power error state changed notification
notificationBase1DCPowerErrorChanged	Base station 1 DC power error state changed notification
notificationBase2FrequencyErrorChanged	Base station 2 frequency error state changed notification
notificationBase2RxSigErrorChanged	Base station 2 receive signal error state changed notification
notificationBase2DataErrorChanged	Base station 2 data error state changed notification
notificationBase2TxPowerErrorChanged	Base station 2 transmit power error state changed notification
notificationBase2DCPowerErrorChanged	Base station 2 DC power error state changed notification

Configurations of SNMP Parameters

To configure the SNMP Parameters within the E-Series programmer, read the E-Series and goto: SNMP Setup. The following configuration window will be displayed.
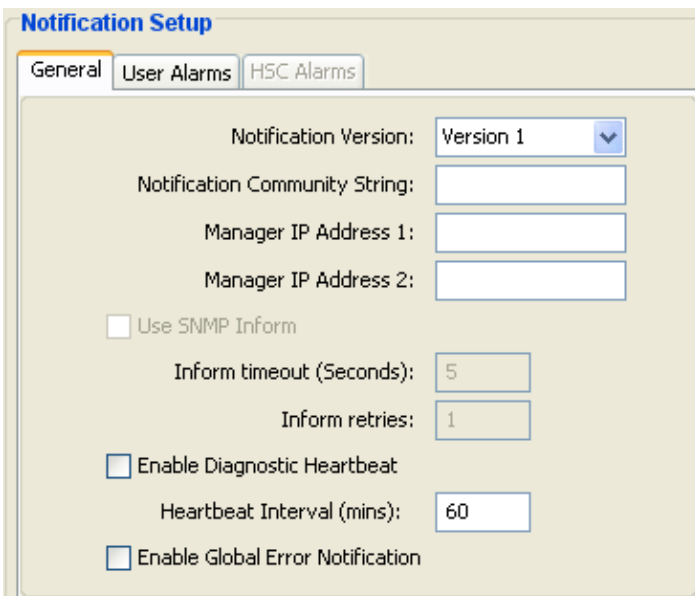

SNMP Enabled: This will toggle the operation of the internal Ethernet E-Series SNMP agent.

SNMP Version: This allows the user to configure the Ethernet E-Series to operate using SNMP protocols 1 or 2c.

SNMP Read community string: This is the community string for reading (getting) SNMP objects from the Ethernet E-Series.

SNMP Read/Write community string: This is the community string for reading and writing (setting) SNMP objects within the Ethernet E-Series.

General:

SNMP Notification Version: This allows the user to configure the Ethernet E-Series to send notifications using SNMP protocols 1 or 2c.

SNMP Trap community string: This is the community string for Notifications.

Manager 1 IP Address: This is the IP address the Ethernet E-Series will send notifications to.

Manager 2 IP Address: This is the IP address the Ethernet E-Series will send notifications to if enabled in addition to other manager IP addresses set. This is used in redundant systems.

Use informs: This toggles between notification types. When enabled, informs will be sent, if disabled, traps will be sent.

Inform timeout: This parameter is only available when informs are enabled. This is the amount of time in seconds the Ethernet E-Series will wait for a response after it has sent an inform. Once the timeout reaches 0, a retry will be sent.

Inform retry: This parameter is only available when informs are enabled. This is the amount of retries theEthernet E-Series will attempt to perform before the inform is discarded.

Enable Diagnostics Heartbeat: This toggles the operation of the Diagnostics heartbeat notification.

Heartbeat: The heartbeat notification used to provide diagnostic information on n Ethernet E-Series. A notification is sent periodically, where the time between heartbeat notifications is defined by the user. The group of diagnostic parameters included within each heartbeat notification include: system name, system location, serial number, model number, temperature (Deg C), temperature (Deg F), supply voltage, system up time, global error state, Tx Power, VSWR and RSSI.

- **OID:** .1.3.6.1.4.1.33302.20.10.13

Global error: The Global error notification is used to indicate changes of state within a group of alarm parameters. These alarm parameters include: Voltage, temperature, Tx Power, VSWR, PLL Lock alarm, sync alarm, fatal alarm and old protocol alarm.

- **Status level states:** Normal (1), User alarm (2) and Critical alarm (3).
- **User alarm limits:** defined by each user defined parameter limit.
- **Critical alarm limits:** Varies for each parameter.
- **Hysteresis:** Varies for each parameter.
- **OID:**.1.3.6.1.4.1.33302.20.10.12

Customising SNMP notifications

Customisations can be made on which SNMP notifications will be active along with the limits that will trigger a notification.

To configure which notifications are enabled, see the User Alarm notification management section found within the User Alarms tab, to configure the limits of each user alarm, also see the User alarms Tab. The configurable notifications available are as follows:

User Alarms

Voltage:

- **Status level states:** Normal (1), User alarm (2) and Critical alarm (3).
- **User alarm limits:** Configurable upper and lower limit, 10000 to 30000 (mVDC).
- **Critical alarm limits:** Lower hardware limit: 9500 (mVDC), Upper hardware limit: 30500 (mVDC).
- **Hysteresis:** +/- 500 (mVDC).
- **OID:** .1.3.6.1.4.1.33302.20.10.6 - ER45E.mib

Temperature:

- **Status level states:** Normal (1), User alarm (2) and Critical alarm (3).
- **User alarm limits:** Configurable upper and lower limit, -40 to +70 (Deg C).
- **Critical alarm limits:** Upper hardware limit: +75 (Deg C). (No lower limit).
- **Hysteresis:** +/- 5 (Deg C).
- **OID:** .1.3.6.1.4.1.33302.20.10.5 - ER45E.mib

RSSI:

- **Status level states:** Normal (1) and User alarm (2).
- **User alarm limits:** Configurable upper and lower limit, -140 to 0 (dBm).
- **Hysteresis:** +/- 10 (dBm).
- **OID:** .1.3.6.1.4.1.33302.20.10.7 - ER45E.mib

Rx Frequency Error:

- **Status level states:** Normal (1) and User alarm (2).
- **User alarm limits:** Upper limit, 0 to 3000 (Hz), Lower limit, -3000 to 0 (Hz),
- **Hysteresis:** None.
- **OID:** .1.3.6.1.4.1.33302.20.10.14 - ER45E.mib

Transmit power:

- **Status level states:** Normal (1) and User alarm (2).
- **User alarm limits:** Configurable upper and lower limit, 0 to +40 (dBm).
- **Hysteresis:** +/- 10 (dBm).
- **OID:** .1.3.6.1.4.1.33302.20.10.8 - ER45E.mib

VSWR:

- **Status level states:** Normal (1), User alarm (2) and Critical alarm (3).
- **User alarm limits:** Optional limit, 1.5:1, 2:1 or 3:1
- **Critical alarm limits:** hardware limit: >10:1.
- **Hysteresis:** None.
- **OID:** .1.3.6.1.4.1.33302.20.10.4 - ER45E.mib

Critical Alarms

PLL Lock error:

- **Status level states:** Normal (1) and Critical alarm (3).
- **Critical alarm limits:** No limits, if the radio detects a PLL lock alarm it will send a Critical alarm notification.
- **OID:** .1.3.6.1.4.1.33302.20.10.2 - ER45E.mib

Sync error:

- **Status level states:** Normal (1) and Critical alarm (3).
- **Critical alarm limits:** No limits, if the radio loses synchronisation with an upstream device, it will send a Critical alarm notification.
- **OID:** .1.3.6.1.4.1.33302.20.10.9 - ER45E.mib

Hot Standby controller notifications

HSC alarms are only configurable during the configuration of a base station. See the user definable HSC notifications below.

HSC Alarms

The HSC notifications are configured within each base station of the hot standby arrangement. The online base will transparently interrogate the hot standby controller for HSC alarms.

A base station can also utilize the input state change notifications when it is a stand alone unit.

Enable HSC Input 1 state change:

- **Status level states:** OFF (0) and ON (1).
- **OID:** .1.3.6.1.4.1.33302.20.10.20 - ER45E.mib

Enable HSC Input 2 state change:

- **Status level states:** OFF (0) and ON (1).
- **OID:** .1.3.6.1.4.1.33302.20.10.21 - ER45E.mib

Enable Changeover Event:

- **Status level states:** Base 1 is online (1) and Base 2 is online (2).
- **OID: .**1.3.6.1.4.1.33302.20.10.1 - EH45E.mib

Base One Notifications

Enable Freq Error:

- **Status level states:** Normal (1), Recovered Alarm (2) Alarm (3).
- **OID:** 1.3.6.1.4.1.33302.21.10.2 - EH45E.mib

Enable RxSig Error:

- **Status level states:** Normal (1), User alarm (2) and Critical alarm (3).
- **OID:** 1.3.6.1.4.1.33302.21.10.3 - EH45E.mib

Enable Data Error:

- **Status level states:** Normal (1), User alarm (2) and Critical alarm (3).
- **OID:** 1.3.6.1.4.1.33302.21.10.4 - EH45E.mib

Enable Tx Power Error:

- **Status level states:** Normal (1), User alarm (2) and Critical alarm (3).
- **OID:** 1.3.6.1.4.1.33302.21.10.5 - EH45E.mib

Enable Supply Error:

- **Status level states:** Normal (1), User alarm (2) and Critical alarm (3).
- **OID:** 1.3.6.1.4.1.33302.21.10.6 - EH45E.mib

Base Two Notifications

Enable Freq Error:

- **Status level states:** Normal (1), Recovered Alarm (2) Alarm (3).
- **OID:** 1.3.6.1.4.1.33302.21.10.7 - EH45E.mib

Enable RxSig Error:

- **Status level states:** Normal (1), User alarm (2) and Critical alarm (3).
- **OID:** 1.3.6.1.4.1.33302.21.10.8 - EH45E.mib

Enable Data Error:

- **Status level states:** Normal (1), User alarm (2) and Critical alarm (3).
- **OID:** 1.3.6.1.4.1.33302.21.10.9 - EH45E.mib

Enable Tx Power Error:

- **Status level states:** Normal (1), User alarm (2) and Critical alarm (3).
- **OID:** 1.3.6.1.4.1.33302.21.10.10 - EH45E.mib

Enable Supply Error:

- **Status level states:** Normal (1), User alarm (2) and Critical alarm (3).
- **OID:** 1.3.6.1.4.1.33302.21.10.11 - EH45E.mib

eDiags - Configuration

eDiags is only typically enabled within the entry point radio of a radio network.

To configure eDiags, first read the radio you wish to enable the eDiags server within using the TView+ Management suite programmer. For further details on TView+ Management suite, refer to part H – TView+ Management Suite - Programmer.

The configuration window for eDiags can be found within the Diagnostics Setup button shown below.

Within the Diagnostics Setup window you will find the configuration parameters for the eDiags server.

Enable: This will toggle the operation of the internal eDiags server.

Local Port: The local port refers to the local IP listening port the eDiags server will use

Primary Controller

Remote IP Address: This is the IP address of the PC running TView+ Management suite (Diagnostics or configurator) or Clear SCADA.

Remote IP Port: This is the port is the eDiags listening port on the PC.

Secondary Controller

Remote IP Address: This is the IP address of the Secondary/ Redundant PC running TView+ Management suite (Diagnostics or configurator) or Clear SCADA.

Remote IP Port: This is the port is the eDiags listening port on the Secondary/Redundant PC.

Part G – Commissioning & Maintenance

Check DC power connector for correct voltage (10-30VDC for ER45e and 11-16VDC for EB45e and EH45e) and polarity, BEFORE plugging in the power connector.

Power-up

Upon power up, the radio will self test and shortly after the green power LED will be displayed.

Failure of the power LED to light indicates no power, or failure of the fuse due to incorrect polarity or over-voltage. Or you may have the System port of the unit plugged into your network, this will cause the radio to go into shutdown mode.

Other failure such as fatal internal errors will initiate error modes as detailed in Part E - Getting Started: LED Indicators and Test Outputs.

LED Indicators

Will depend on the system architecture. If the device is a remote site receiving a base station with a constant carrier, then the RXSIG/SYNC LED should be green to indicate healthy reception of the wanted signal.

If the site has been configured as a constantly transmitting base station, then the PWR/TX LED should show red.

In other types of systems, TX and RX bursts would be indicated by the RX or TX LED's as above.

Data flow to and from the data port is indicated by the TXD/RXD LED for the data port.

The "Active/Link" LED is used to indicate the state of the LAN port.

(See Part E – Getting Started: LED Indicators and Test Outputs.)

Data Transfer Indications

Bi-colour LEDs are provided to indicate RS232 data being transmitted and received on the data port. A RED flash indicates a byte (or bytes) of incoming data from the serial line which will be transmitted to air, and a green flash indicates a byte of data received "off air" being released onto the serial line.

If data is being sent to the radio modem and the Data LED does not flash RED, this may indicate a wiring or configuration problem. Check that the TX and RX data lines are correctly wired (see Part E – Getting Started: LED Indicators and Test Outputs).

Also check that character set and parity settings (i.e. N,8,1 etc) are set identically at the terminal and the radio modem. Note that some incorrect settings of the character set parameter can still produce transmittable data, even though the data will not be understood by the application.

The "Active/Link" LED is used to indicate the state of the LAN port. lf the LED is OFF, there is no activity at all on the LAN port. A GREEN indication shows an established Ethernet link. The LED will flash AMBER to indicate Ethernet data transmission is occurring.

Antenna Alignment and RSSI Testing

Once the RXSIG LED is lit, it is possible to confirm RX signal strength and align a directional antenna by monitoring the RSSI output.

This DC voltage appears at Pin 9 of Port B.

A ground reference can be obtained from chassis ground or Pin 5 of Port A or B.

The chart below shows Pin 9 voltage as it relates to signal strength.

Analog RSSI Output Characteristics - E Series Data Radio
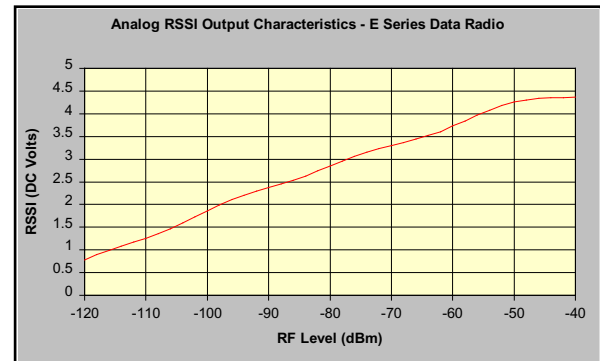
Please note that the RSSI table values are for indicative use only.

Link Establishment and BER Testing

Once communications has been established, it is possible to confirm the packet error rate performance of the radio path, and thus estimate the BER figure.

There are a number of tools provided to do this. The easiest is to use the "indicative packet error test" provided within the TView+ Diagnostics under "statistical performance tools". Alternatively, it is possible to use hyper terminal, or other packet test instruments or PC programs to run end to end or perform "loopback" testing.

Please note that when using a "loopback plug" some understanding of the packetising process is necessary, since each "test message' must be carried in a single packet for meaningful results to be obtained.

Note also that in PTMP systems, allowance must be made for collision potential if other data is being exchanged on the system.

VSWR Testing

VSWR testing is achieved using specialized VSWR testing equipment, or a "Thruline" power meter that measures forward and reverse power.

VSWR is the ratio between forward and reflected transmitter power, and indicates the health and tuning of the antenna and feeder system.

VSWR should be better than 2 to 1, or expressed as a power ratio, <6dB or no more than 25%. To activate the radio's transmitter for VSWR testing, use:

a) An RTS loop (PTT via RTS must first be enabled within the radio via programmer. On the DB9 port, tie pins 7 & 8 together.

b) A system port PTT plug with pins 7&8 shorted.

Testing Ethernet Connectivity

This is the sequence of steps required for configuring two Ethernet E-Series in a point-to-point network. One will be configured as an Access Point and the other as a Remote.

Step 1 – RF and DC power connection

Connect a whip antenna or suitable attenuation to the N-Type antenna connector of both radios.

Ensure the whip antennas you are using are for the correct frequency otherwise a high VSWR error may occur.

Check the DC polarity and ensure the DC voltage is between 10V and 30V with a maximum current capacity of 1Amp (nom 500mA). Incorrect polarity or excessive voltage may result in a blown fuse!

Step 2 – Power Up Radios

Apply DC power to the radios. The "Pwr" LED should now be solid GREEN.

Wait 45 seconds for the boot up sequence to be complete. This will be indicated when the Sync/NoRx LED flashes at a rate of once a second.

Step 3 – Preliminary Configuration

IP Address and Factory Default

The default IP address of the Ethernet E-Series radio is 192.168.2.15. Configuraition of the Ethernet E-Series is done via the TView+ Management software. The IP address can be set back to the factory default setting by factory defaulting the unit.

This can be done by powering up the radio (wait 45 seconds), depress the factory default switch using a paper clip or similar thin blunt wire and keep the switch depressed for 5 seconds. All 4 LEDs will illuminate solid GREEN indicating the radio will return to factory default settings. Please wait 30 seconds with the factory default reset process to occur.

Ethernet Configuration Ping Test

Connect your PC LAN Port to the Ethernet Ports (LAN).

The corresponding Link/Activ LAN LED will illuminate continuously Green. If data is being transferred, the Link/Activ LAN LED may also flash Amber.

To verify your PC can communicate with the J-Series you should first use the "ping" utility to test the connection to the Ethernet Port.

Open up a command window on your PC by going to the "Start" -> Run and typing "CMD" then OK. Then type "ping 192.168.2.15" which is the default address of the radio.

If both the radio and PC have their LAN port connection and configuration correct, the radio will respond to the ping. If this is not the case, check you network settings.

Routine Maintenance Considerations

The Ethernet E-Series hardware itself does not require routine maintenance. However all radio products contain crystal frequency references, and the stability of these crystals changes with time. The effect of this is that the product will slowly drift off frequency, and eventually it will require re-calibration. E 45e radios are designed with high quality, low drift specification references, to ensure a long maintenance free lifespan. The length of this lifespan will depend on the severity of temperature extremes in the operating environment, but is normally 3–5 years. Extended frequency drift can be detected using TView+ Diagnostics "Freq error" parameter.

Generally, re-calibration is achieved by replacing the radio in the field with a spare, and returning the radio to a service centre for re-calibration and specification testing at moderate cost.

Routine maintenance should be performed on external equipment subject to greater environmental stresses including antennas, RF feeder cables, backup batteries and cooling fans (if required). This maintenance should include testing of site commissioning figures such as received signal strength, VSWR, P/S voltage etc.

Ethernet E-Series Error LED indications

Fatal error indications are indicated with by only flashing all the red LEDs. This sort of error indication requires the radio to be returned to the factory for service.

Serious error indications will be indicated by illuminating all the red LEDs followed by an error specific sequence of green LEDs as shown in the table below.

Port A	Port B	Rx/Sync	Tx/Pwr	Error Type
			●	Supply Voltage Error
	●			Factory default failed – try factory defaulting again
	●		●	Configuration error – try reconfiguring again
	●	●		Firmware upgrade error – try uploading firmware again
	●	●	●	Reverted to factory default due to internal error
	●	●	●	IP Address not set (only in DHCP mode)
●			●	*Tx Synth Out Of Lock
●		●		*Rx Synth Out Of Lock
●		●	●	*Tx & Rx Synth Out Of Lock
●	●			Configuration record not found
●	●	●		Over Temperature Error (PA output power has folded back)
●	●	●	●	VSWR Error (PA output power has folded back)

Part H – TView+ Management Suite - Programmer

Introduction

This manual covers the installation and operation of the Ethernet E-Series TView+ Management Suite which incorporates 3 utilities:

- Programmer for configuration of the radio RF parameters, system parameters and data ports

- Diagnostics* for real-time monitoring and logging of radio performance parameters

- Firmware Update for loading new firmware releases into the radio data modem

All utilities can be run on any IBM compatible computer running Windows 2000® and above. This section describes use of the programmer and firmware Update utilities in detail. Users should refer to the separate WinDiags User Manual for information about this utility.

The programmer is used to set configuration parameters within the ER45e data radio modem and EB45e base station. The utility permits configuration of modems connected directly to the PC as well as over the air to a remote unit. Configuration parameters can be saved to a disk file for later retrieval, or used for clone programming of other modems.

All configuration parameters are held in non-volatile memory (NVRAM) on the Data Radio Modem. Configuration is fully programmable via the Systems Port using the programming adaptor and cable supplied. Disassembly of the unit is not required for any reason other than for servicing.

The diagnostics utility permits monitoring and logging of radio performance parameters for the E 45e Ethernet radio Range, E Series* and M Series* data radio modems and base stations. It supports homogeneous systems of radios as well as mixed systems of E 45e, E450 and M450 series radios.

The firmware update utility permits field upgrade of the firmware in an ER45e Ethernet radio modem, EB45e base station and EH45e hot standby unit connected directly to the PC. For front panel and controler firmware updates, an E-Series programming cable is required to be connected to the units system port. To load firmware into a radio, IP connectivity is required.

* Requires the optional DIAGS Network Management and Remote Diagnostic Facility to be installed - per radio.

Installation

Unit Connection

Programmer and Diagnostics Utilities

The unit is connected to the PC using the supplied DB9-RJ45 adaptor cable (part no. TView+ Cable) for local configuration changes or diagnostic monitoring. The cable should be connected to the RJ45 System Port of the unit and a valid PC serial port (e.g. COM 1) DB9 connector.

(See Part E - Getting Started: Communications Ports)

Global Firmware Update Utility

All firmware upgrades performed to an Ethernet E-Series must be done via the unit's LAN port.

Software

Please take a moment to read this important information before you install the software.

The installation of this Software Suite is a 2 step process.

Step 1 completes the typical installation of the TView+ Management Suite and will install the Programming Software together with the E 45e documentation.

Step 2 installs the Diagnostic Software and is optional. This step is only required if your radios have Remote Diagnostics enabled.

STEP 1: Installation - TView+ Management Suite

Note: If a previous version of the TView+ Management Suite has been installed on your PC, you must uninstall it via Control Panel "Add/Remove Programs".

- Close down all other programs currently running.

- Place the CD-ROM in the drive on the PC.

- Using Windows Explorer locate the files on the CD-ROM.

- In Windows Explorer double click on the file called TView+_(Version#)_install.exe

- After the installer starts follow directions.

STEP 2: Installation - TView Diagnostic Software (Optional)

Note: If a previous version of the "TView WinDiags" software has been installed on your PC, you must uninstall it via Control Panel "Add/Remove Programs".

- Close down all other programs currently running.
- Place the CD-ROM in the drive on the PC.
- Using Windows Explorer open the "Diagnostics" directory on the CR-ROM.
- Double click on the file called setup.exe
- After the installer starts follow directions.

Other:

The current E Series Ethernet Manuals are supplied and installed as part of the TView+ Management Suite installation in Adobe Acrobat format.

Adobe Acrobat Reader is provided on the CD-ROM for installation if required.

TView+ Front Panel

When started the TView+ front panel appears. The larger buttons permit each of the five utilities to be started. The diagnostics button may be greyed out if this utility has not been installed or found in the correct file directory. Access to Advanced Set-up Parameters and an exit facility are provided by the remaining 2 buttons.
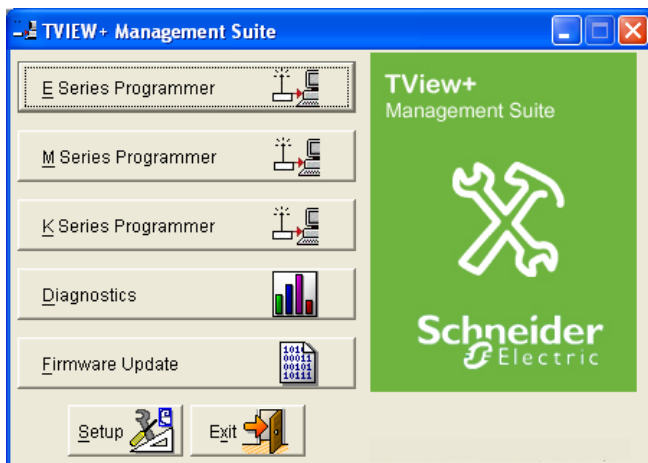
Programmer

Main Window

When first started, the programmer is in file mode as indicated by the mode field at the bottom right of the panel shown below. In this mode it is possible to open a previously saved configuration file, or configure various programming options and save the configuration to a file. Also when first started the programmer will be in ER450 mode. The Mode can be switched by going to -> Modem -> E-Series and selecting ER-45e, or simply connect locally to an ER45e unit and select read on the programmer.

To commence programming a unit (radio remote or base station) a session must first be established by using the "READ" function. If you have a Hot Standby Set-up and are locally connected to the Hot Standby Controller, The programmer will read the currently 'active' Base. To select which base you want 'active' there is a switch on the front panel of the Hot Standby Controller that controls active base toggling.

The READ function reads the current configuration from the unit and displays it in the main window. The "mode" displays changes to local or remote depending on the type of session selected at the read function. Several options in the main window may be blanked out until a session has been established with a unit.

Note: Changing any item on the menu will in general not take effect until data is written back to the unit using the "WRITE" function.

The procedure to follow for normal programming of unit is:

- Read unit
- Configure parameters (or Open a previously saved configuration file)
- Write unit

Several modems of the same radio type can be programmed with the same configuration using the clone facility described in Clone Mode. It is important to note that when using this facility the cloned radio should be of the same type to ensure it does not operate outside its capability.
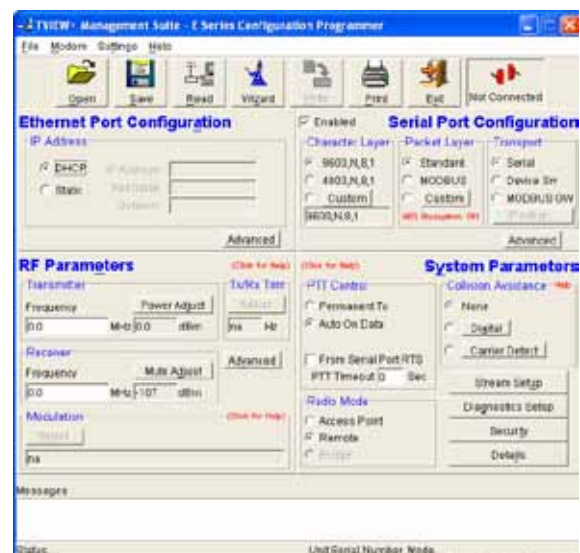
Pull Down Menus and Toolbar Buttons

The items on the pull-down menus can be selected either directly with a mouse or using the ALT key in combination with a HOT KEY (e.g. ALT-F to select the file menu). Several of the functions within each menu are also available on the toolbar (click once to select).

File Menu

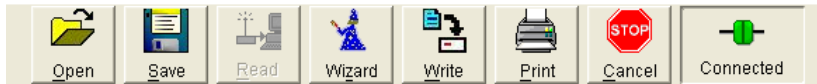The file menu allows the user to load (open) or save configuration data as well as to quit the program. The files are saved with an ".cfg" file extension

Open (also available on the toolbar)

This function is used to load an existing configuration file that can be used to directly program the radio or to use as a starting point to edit configuration parameters. Note that a session must be established with the unit by initially reading the configuration parameters from the unit prior to being written to a unit.

If in file mode the modulation type will not be displayed. If in local/remote mode and a file that was saved from local/remote mode is opened, then modulation type will be imported and used, but only if it is valid for the connected hardware. If not, then the unit's read modulation type will be used.

Save (also available on the toolbar)

This function is used to save the current configuration parameters to a file for future recall.

If in "file mode" only basic RF, Port and System parameters are saved and re called. If in local/remote mode then modulation type is saved and re called.

Print (also available on the toolbar)

This function prints out the configuration data to the default printer in a standard format. There are no options for this item.

This should be used if a complete record is required for site/unit configuration. Firmware/Modulation/Diags/Hardware type are all printed.
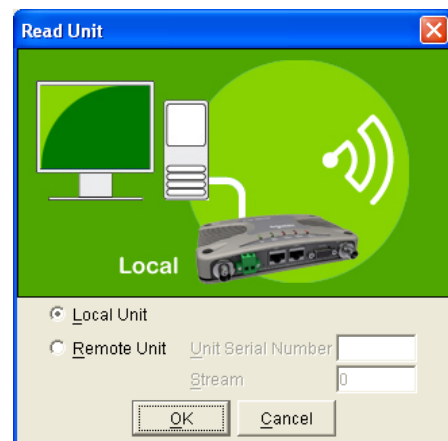
Exit (also available on the toolbar)

This function terminates the program. The user is requested to confirm this selection before exiting the application.

Modem Menu

This radio menu allows configuration data to be read from and written to the unit (remote radio or base station) using the selected PC serial port connection (see Settings menu). The action of reading the configuration establishes a session with the unit. Communications is maintained with the unit to ensure that the session remains open. If the session has been lost due to data transmission errors or disconnection of the programming cable it will need to be re-established to ensure any updated configuration is written successfully to the unit.

Read (also available on the toolbar)

This function establishes a session with the unit, reads configuration data from the unit and displays it in the programmer main window. When selected a dialogue window appears prompting the user to choose whether the unit to read is local (connected directly to the serial port or remote (connected over the air to the unit connected to serial port). Unit no. (Serial no.) must be entered and the stream SID code is "on" (default =0)). After configuration data is read from the unit it is available for editing and writing back to the unit or saving to a file. The progress of data transfer to or from the unit is indicated by a message window as well as a rotating indicator in the bottom right hand corner of the main window.

Write (also available on the toolbar)

This function writes configuration data displayed in the main window to the unit and reboots the unit. When selected a dialogue window appears prompting the user to confirm whether to proceed. A progress indicator in the bottom right hand corner of the main window is displayed while data is being read. This selection is only available if a session has been previously established and maintained with the unit.

This dialogue provides a facility for reversing any remote configuration changes that cause unexpected results resulting in the device reverting to previous configuration if contact is lost.
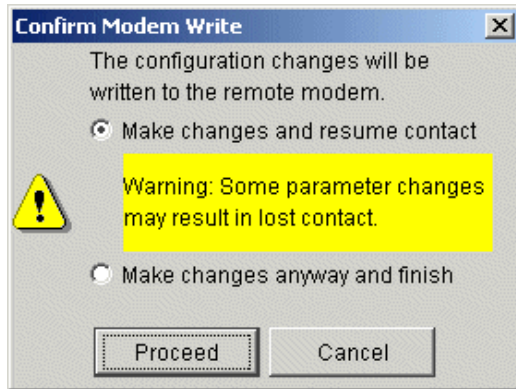
Choose "Make changes and resume contact" to safeguard changes. Some parameter changes (such as frequency change) will, by definition, automatically result in lost contact.

Choose "Make changes anyway and finish" to complete intentional changes which will result in lost contact.

After configuration data has been written, the session with the unit is closed and the programmer reverts to file mode.

Note: In general, any change made on the programmer screen must be written to the unit (using the write function) to become permanently stored. However, changes to Power adjust, Mute adjust and Tx/Rx trim take immediate effect to allow test and adjustment prior to permanent storage via the write function.
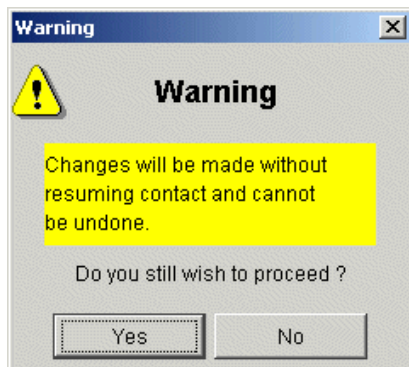

Cancel Session (also available on the toolbar)

This function closes the session with unit and puts the programmer back into file mode. All configuration changes are discarded including changes to Power Adjust, Mute Adjust and Tx/Rx Trim.

Wizard (also available on toolbar)
This function permits the user to select standard configurations after the configuration from a unit has been read or a file opened.
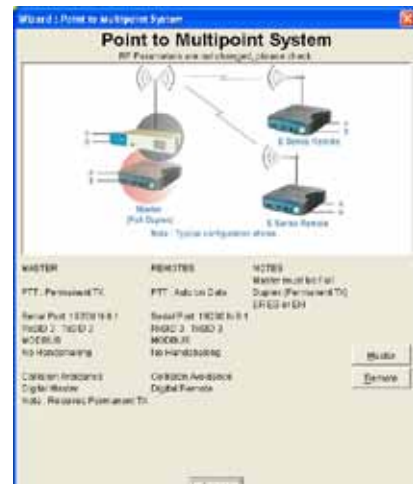
Clone Mode

This function permits writing of the same configuration data to several units. This feature is normally used for configuring data radio modems connected locally.

The procedure is:

- Read the configuration from the first unit.
- Configure the parameters (or open a previously saved configuration file).

The user is prompted via a series of dialogue windows to select the desired configuration that can then be written to the unit (remote radio or base station).

- Select Clone Mode (Modem menu).
- Write the configuration to the first unit.
- The changes will take effect when unit is repowered.
- Connect the next unit.
- Write the next unit which establishes a session and recognises the unit serial number and type, which then configures the unit
- Repower the unit for changes to take effect
- Repeat the last 3 steps for the remaining units.

Settings
This menu permits selection of the PC serial port (COM1 to COM 99 if available) to be used for communications with the unit. COM1 is the default selection and if a different port is to be used it must be set before establishing a session by reading the configuration from a unit. Whilst a session is established with a unit this menu can not be accessed.

Help
The Help buttons within the Programmer will automatically take you to section within the user manual when you click it.

eConfig

econfig can be used to perform radio reconfigurations via an Ethernet connection. For a detailed example on how to use eConfig, please refer to part F.

Units serial number: defines which unit the programmer will attempt to establish a configuration session with. You must enter a valid Ethernet E-Series radio serial number (must be between 0 and 999999).

Local Port:

- Dynamic: This allows a dynamic port selection. Ensure you have the latest available firmware activated within your radio to ensure this feature is available.

- Static: This defines the IP port number TView+ will listen on during the configuration read. Range is 1 to 65535.

Remote IP Address: This is the IP address of the network entry point radio (must have eConfig server enabled). This must be a valid IPV4 IP address.

Remote IP Port: The IP Port TView+ will address during a configuration read. Range is 0 to 65535.

Ethernet Port Configuration

The Ethernet E Series radios have the option to manually configure your IP parameters (Static) or have the unit obtain IP information automatically (DHCP).
Static IP configuration - Once Static has been selected, you can manually configure your IP parameters.

Note: The Ethernet E-Series will currently act as a layer 2 device, and NOT as a layer 3 router.

IP Address:
your IP address gives your radio a host/network interface identification and network location address. This will allow Ethernet Data packets to be delivered to specific nodes within your network.

Net-Mask:
The Net-Mask will block access to the radio itself from other devices outside its configured mask range. The subnet mask of the radio will not prevent the transmission of Ethernet data entering the Ethernet port from external devices.

An example of where the radio's subnet mask would have bearing is a terminal server application, where if the remote IP address parameter in the radio is set outside of the subnet mask the message will be forwarded to the gateway address instead.

Gateway:
The Gateway is the node within your network, typically a router, that your unit will send data to when the destination of an Ethernet Packet falls outside of the units Net-Mask.

Advanced:

Ethernet Filtering

This section provides the configurable parameters for MAC layer filtering. The various options of MAC filtering include:

Allow all Ethernet traffic:
Allowing all Ethernet traffic to be sent over the air will effectively turn the MAC layer filtering OFF.

Allow ARP and Unicast:
Allowing ARP and Unicast traffic to only be sent over the air will filter out all other protocols such as spanning tree and broadcast messages which can be produced by a typical LAN/WAN and overwhelm a narrow band radio link.

Allow Unicast only:
Allowing Unicast traffic to only be sent over the air will filter out all other protocols such as spanning tree, broadcast and ARP messages which can be produced by a typical LAN/WAN and overwhelm a narrow band radio link.

Allow traffic from single MAC only:
Allowing traffic from a single MAC address will allow all protocols from the specified MAC address and filter out all other traffic from any other MAC address.

Ethernet Link Monitoring

This section provides the configurable parameters for redundant Ethernet Link monitoring. These parameters are only available within a Base station unit in a Hot Standby arrangement. The configurable parameters for this feature include:

Enable Ethernet Link Monitoring:

This tick box enables the Link monitoring feature.

Target IP Address (Primary):
This parameter is the destination IP address the Base station will ping to ensure the Ethernet link to the primary device is always connected. If the destination IP fails the ping test and has been declared a failure, the base will attempt a ping test with the secondary IP Address. If the secondary IP address has not been configured or the secondary destination IP fails the ping test and has been declared a failure, the online Base will initiate a hot standby change over.

Target IP Address (Secondary):
This parameter is the destination IP address the Base station will ping to ensure the Ethernet link to the secondary device is connected. The base will only begin this secondary link monitoring after the primary link has failed the ping test and has been deemed a failure. The Base will always attempt to ping the Primary IP address before each ping of the secondary IP address to check if the primary path is once again available. If the primary link has been re-established after it has been declared a failure, the base will stop monitoring the secondary link.

Time Between Pings:
This Parameter is the amount of time between pings or how frequently the base will check the Ethernet link. The time between pings is in seconds and has a configurable range of 5 to 3600.

Failure Count Threshold:
This parameter is the amount of failed pings the base will allow before the link has been deemed a failure. The configurable range is 1 to 255

HSC Shared IP
The Hot Standby Controller Shared IP address allows 2 base stations in a hot standby pair to share a single IP address

Enable Shared IP:
This tick box enables the Shared IP address feature.

HSC Shared IP:
This parameter is the IP address the Hot standby will share between the 2 base stations.

Data Port Configuration

Data from this user ports is multiplexed for transmission over the air. The Data Port can be configured separately for the Character layer (Data speed, number of data bits, number of stop bits, parity), Packet layer and Handshaking (flow control). The Data Port must be enabled if required. You can do this by setting the check box at the top of its configuration section.

Character Layer

There are two standard formats and a custom format that can be selected by checking the appropriate control button to the left of the description. The standard formats are:

- 9600,N,8,1 (data speed = 9600 bps, no parity, 8 data bits, 1 stop bit)
- 4800,N,8,1 (data speed = 4800 bps, no parity, 8 data bits, 1 stop bit)

A non-standard format can be selected via the Custom button that displays a dialogue box to permit selection of data speed, parity, number of data bits and stop bits. Once selected the OK button should be used to complete the selection. The custom selection is also displayed in the main window below the Custom button.

Packet Layer

There are two standard configurations and a custom configuration which can be selected by checking the appropriate control button to the left of the description. There are essentially two basic modes of operation for the packet assembler and disassembler (PAD).

The first is where the PAD operates in a standard mode with data received at the port being immediately sent over the radio channel.

The second is a store and forward or delayed mode where whole data packets are received from the port before being sent over the radio channel.

In both cases data is sent over the radio channel in variable length

In both cases data is sent over the radio channel in variable length frames and delineation of these frames is dependent on the configuration selected as well as the characteristics of the data stream received at the data port.

The packet layer configuration options which can be selected are:

Standard (live framing)

With standard live framing data received from the host by the modem is immediately placed into a frame and transferred onto the radio channel. This minimises "store and forward" delays in the data transmission.

If a stream of characters is received by the modem, then several characters at a time may be placed into the same frame. The number of characters in the frame depends mainly on the respective baud rates of the user port and the primary channel baud rate of the modem, as well as the level of overheads experienced on the radio channel and the user data stream.

The number of data bits associated with the user data stream will also have an effect on the average size of a frame. For instance the number of stop bits, and number of data bits per character.

The system designer must choose the best compromise of all the above items to ensure the most efficient method of data transmission.

Note: The first few characters are always packetised and sent by itself regardless of all the above variables.

Modbus

This selection configures the PAD driver with options automatically set to implement the MODBUS protocol, e.g. 5 mSec timer.

Custom

Other configurations of the PAD driver can be selected via the Custom button which displays a dialogue box to permit selection of several configuration options as follows:The diagnostics controller package uses the SLIP protocol to communicate between base station and remote modems.

DNP-3 / IEC870
This selection configures the PAD driver to implement the DNP-3 Protocol and IEC870 Protocol.

Pull Down Menu Selection

The PAD driver can be configured for a number of vendor specific protocols by selecting the desired option.

Custom Format
This selection permits PAD driver to be configured in a variety of ways and requires a greater understanding of the system design.

For the modem to successfully transmit its packets (or frames) of data over the radio channel, it must be told on what basis to delineate data packets received at the data port. Once the end of a data packet has been received at the port the data frame is closed and transmission over the radio channel commences. Delineation of data packets can be configured to occur via any combination ofA pre-defined minimum time delay between packets received at the port. Typically the time delay would reflect the absence of a couple of characters in the data stream at the specified user port baud rate.

- Limiting the maximum number of characters which can be put in the data frame sent over the radio channel.

- Receipt of a selected end of message (EOM) character at the port. An ASCII carriage return (character 13) is often used for this purpose.

As each data frame to be transmitted over the radio channel has overhead data consisting of checksums and SID codes. The system designer must determine the best compromise between the ratio of overhead versus user data which depends on packet size and user data packet transmission latency.

SLIP / DIAGNOSTICS

SLIP is a well known protocol for transferring binary data packets over a data link. Each data packet is delineated by <FEND> characters, and a substitution mechanism exists that allows these characters to be included in the data packet. Appendix B describes the SLIP protocol which is used extensively in UNIX™ based systems, and is closely associated with TCP/IP networks.

The fields which can be configured are:

- Character Input timer: Set the input timer value in ms or enter zero to disable. Range 0 - 255.

- Maximum Frame Size: Set the maximum number of characters or enter zero to disable. Range 0 - 4095.

- Minimum Frame Size: Set the maximum number of characters or enter zero to disable. Range 1 - 255. Only available when AES Encryption is on.

- EOM Character: Select the check box to the left of the description to enable and enter the EOM character as a decimal value. Range 0 - 255.

- LIVE Framing: Select the check box to the left of the description to enable live framing mode.

Note : When AES encryption has been turned ON, the packet layer is modified to suit the fixed format requirements of AES encryption. This may result in changes to the data latency and throughput in some modes.

Transport

There are three different methods of transporting serial data that has been received on the data port. These methods can be configured via the transport menu.

Serial:

Selecting the serial tranport method will configure the radios data port to apply the SID rules defined in the stream setup to any in comming or out going serial data transmissons. For further detail on how to configure the stream setup, please see Part G, Stream Setup.

Device Srv (Server):

Selecting the device server transport method will configure the radios data port to behave as a terminal server. To configure the terminal server, select IP Setup.

Modbus GW (Gateway):

Selecting the MODBUS gateway transport method will configure the radios data port to behave an a MODBUS gateway. To configure the MODBUS gateway, select IP Setup.

IP Setup:

The IP Setup provides the option between 3 different layer two protcols when using the Device server transport method: TCP, UDP and PPP and 2 different layer two protocols when using the MODBUS gateway transport method: TCP and UDP

For details on how to configure TCP or UDP, please refer to the virtual terminal server/MODBUS gateway instructions in part G of this user manual.

PPP: (Device Server mode only)
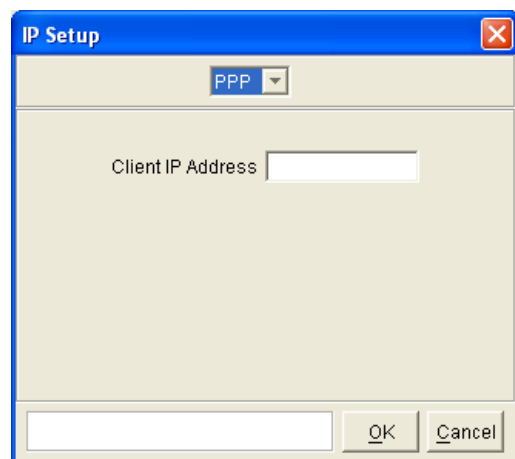
Once PPP is selected, the window willl show the Client IP address parameter.

- Client IP Address: This parameter defines the IP address of the destination remote that the radio will be establishing the Point to Point link with.

Advanced

This button provides access to the advanced features of the port configuration. When selected a dialogue box appears which permits selection of the source of the port DCD output signal.
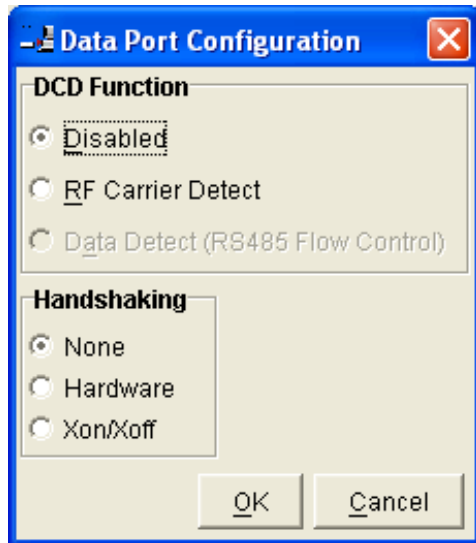
Disabled

This selection disables the DCD output on the port. This selection is not permissible if hardware based flow control has been selected.

RF Carrier Detect

This selection causes DCD to be asserted at the onset of a an RF signal that is higher than the mute setting. This will generally occur several milliseconds before data is transmitted from the port.

Data Detect (RS485 Flow Control)

This selection causes DCD to be asserted when data is about to be transmitted from the port. This option is not available if handshaking is set to "None" or "Xon/Xoff".Handshaking

If the standard PAD is selected (i.e. Any settings apart from SLIP/Diagnostics), then flow control can be either hardware handshaking, XON/XOFF protocol or none.

The XON/XOFF flow control is not supported when using the SLIP/Diagnostics protocol.

The Handshaking section of the screen allows the selection of either of the handshaking methods as well as allowing handshaking to be disabled.

Details of the two handshaking methods are given below.

Hardware

The modem acts as Data Communications Equipment (DCE) and supplies to the host controller the following interface signals:

Data Set Ready	(DSR)
Data Carrier Detect	(DCD)
Clear To Send	(CTS)
Receive Data Output	(RXD)

The host controller must act as Data Terminal Equipment (DTE) and supplies to the modem the following interface signals :

Data Terminal Ready	(DTR)
Request To Send	(RTS)
Transmit Data Input	(TXD)

DCD: DCD has several modes of operation. It is set to TRUE when data is being transferred from the modem to the host - RXD line active. The signal is asserted approximately 500ms before the start bit of the first character in the data stream and remains for approximately 1 character after the last bit in the data stream. The other modes of operation are dependent on the advanced settings.

DSR: DSR is permanently set to TRUE.

CTS: The CTS is a signal from the modem to the host informing the host that the modem is able to accept incoming data on the TXD line. It responds to the actions of the RTS line similar to the operation of a "standard" line modem.

The CTS is FALSE if the RTS line is FALSE. Once the RTS line is set to TRUE (signalling that the host wants to send some data to the modem on the TXD line), then the CTS will be set TRUE within 1ms, if the modem is capable of accepting more data.

The CTS line will be set to FALSE if the transmit buffer in the modem exceeds 4075 bytes, or the number of queued frames exceeds 29 to ensure that no overflow condition can occur.

RTS: The RTS line is used for two reasons. The first is to assert the CTS line in response to RTS. The RTS line can also be used to key up the transmitter stage of the modem.

DTR: The DTR line is used for flow control of data being sent from the modem to the host controller. When the host is able to accept data it sets this line to TRUE, and if data is available within the modem, it will be sent to the host. If the host cannot accept any more data, then it sets the DTR to FALSE, and the modem will stop all transmissions to the host.

Permits selection of the source for the port DCD output signal.

Xon/Xoff

If the flow control mechanism is XON/XOFF then the modem uses the standard ASCII control codes of DC1 {^Q=11(Hex)=17(Dec)} for XON and DC3 {^S=13(Hex)=19(Dec)} for XOFF. The DTR input line is totally ignored.

Note: There is no substitution mechanism employed in the XON/XOFF protocol, so care must be taken when transferring binary data to ensure that invalid flow control characters are not generated.

RF Parameters

This section of the main window permits adjustment of transmitter and receiver, radio channel modulation scheme, frequency trim and advanced features.

Transmitter

The transmitter can be configured for transmit frequency and power level.

Frequency

The required transmit frequency in MHz can be entered in the display field. The programmer checks that the selected frequency is in the range for the particular model of radio and provides warnings if it is not.

Power Parameters

Remote - Minimum: 15dBm, Maximum: 38dBm

5W Base - Minimum: 30dBm, Maximum: 38dBm

20W Base - Minimum: 37dBm, Maximum: 43dBm

Power Adjust

The currently selected transmit power is displayed below the button in dBm. The power level can be adjusted by selecting this button which displays a dialogue box. The up/down keys, or a typed in value, can be used to select the required power level in dBm steps. There are two methods for setting the power.

Using Factory Calibration

To use the factory calibration of the radio the desired power is set immediately using the OK button in the dialogue box. This method permits the transmit power to be set without energising the transmitter. Note that although the transmit power has been adjusted it must be written to NVRAM using the modem "Write" function to ensure it is retained after a power on reset.

Using a Power Meter

To overcome manufacturing variations in the power setting a more accurate setting of power can be achieved by the selecting the "Test With Meter" button in the dialogue box. This displays another dialogue box warning the user that the transmitter is about to be energised and that the power meter used should be able to handle at least 10 Watts from the modem. Selecting OK in this warning dialogue box will energise the transmitter which will also be indicated by the red transmit LED on the unit. The power is adjusted using the up/down keys until the required power level is obtained. Selecting OK will retain the power setting and turn the transmitter off. Note:

Although the transmit power has been adjusted it must be written to NVRAM using the modem "Write" function to ensure it is retained after the modem is rebooted. Selecting "stop test" will stop and leave you in power adjust box. "Cancel" will stop test and take you back to the main window.

Receiver

The receiver can be configured for receive frequency and mute level.

Frequency

The required receive frequency in MHz can be entered in the display field. The programmer checks that the selected frequency is in the range for the particular model of radio and provides warnings if not.

Mute Adjust

The currently selected mute level is displayed in the main window below the button in dBm. The mute level can be adjusted by selecting this button which displays a dialogue box. The up/down keys, or a typed in value, can be used to select the required mute level in dBm steps. Whilst a session is in progress with a unit the mute level adjustment is live. Selecting OK will retain the mute level setting. Note that although the mute level has been adjusted it must be written to NVRAM using the modem "Write" function to ensure it is retained after the modem is rebooted.

Whilst the modem is capable of receiving extremely weak radio signals, and successfully extracting the data content from the waveforms the mute level should be set to assist the modem in filtering out unwanted signals. Unwanted signals can be the result of background noise or interference. The mute level should be set at a level above these unwanted signals and at a level low enough to detect the wanted signal. Detection of a received signal above the mute level is indicated by the "RxSig" LED on the unit.

Modulation

The radio modem utilises a DSP to control the modulation of transmit signals and demodulation of received signals. This provides greater flexibility in the ability of the radio modem to support new modulation schemes whilst maintaining compatibility with existing modulation schemes.

The currently selected modulation scheme is displayed in the main window below the select button. The modulation scheme can be adjusted by selecting this button which displays a dialogue box. The desired modulation scheme can then be selected from the pull-down menu in the dialogue box and retained using the OK button.

The type of modulation available for selection is dependent on the model of radio. Modulation types are sorted using the following criteria : Country of Approval (FCC, ETSI, ACA), Radio Channel Bandwidth (12.5kHz or 25kHz), Radio Mode (E Series, M Series, D Series or Legacy) and over the air speed (2400bps, 4800bps, 9600bps, 19k2bps).

Only modulation schemes suitable for the radio model in use are available for selection. Please consider the following notes when choosing a modulation:

Country of Approval :

FCC : for use in North America and other countries who use FCC approved radios.

ACA : for use in Australia and New Zealand.

ETSI : for use in Europe and other countries who use ETSI approved radios.

Legacy Modulation Schemes: Some modulation types are specifically for backwards compatibility. This includes D Series compatibility mode. These legacy modes should only be chosen when backward compatibility is required as their performance is inferior to the generic modulation schemes (bandwidth and RF sensitivity).

Tx/Rx (Frequency) Trim

The currently selected frequency trim, which is common to both transmitter and receiver, is displayed in the main window below the button in Hz. The frequency trim can be adjusted live by selecting this button which displays a dialogue box. The up/down keys can be used to select the required frequency offset in steps pre-determined by the radio modem. Selecting OK will retain the frequency trim setting. Note that although the frequency trim has been adjusted it must be written to NVRAM using the modem "Write" function to ensure it is retained after the modem is rebooted.

This facility permits correction for drifts in the frequency reference caused by component aging. For example, a standard crystal may vary in fundamental frequency operation over 1 year by one part per million. An adjustment range of 1 10ppm, displayed in Hz, has been allowed for and if this is insufficient the unit should be returned to the dealer/factory for re-calibration.

Advanced
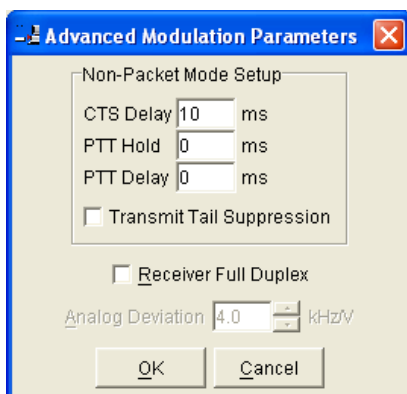
Receiver Full Duplex

This check box should only be ticked when the radio is operating in "full duplex" mode and with a "full duplex" hardware platform. For standard half-duplex remotes this option should not be ticked. For other modes please consult the factory for further information.

Note: This parameter is set in the factory to the correct state and should not be altered without factory consultation. System Parameters

This section of the main window configures the PTT control, collision avoidance, stream setup for routing of data, advanced features and provides unit information.

PTT (Press To Transmit) Control

RF transmission can be configured to occur permanently, automatically on data received on the Serial Port, or RTS being asserted on the Serial Port. A PTT timeout facility can be configured to limit the period for which the transmitter is enabled. Each option is selected by setting the control to the left of the description on the main window. When PTT is active the "Tx" LED on the unit is illuminated and RF power is being fed to the antenna.

Permanent Tx

This will cause the transmitter to be permanently enabled (keyed) and displays another dialogue box warning the user that the transmitter will be energised immediately after the configuration is written to the unit. Selecting OK confirms this setting. The other PTT selections are disabled when this option is selected.

Note: This option is only available for full duplex units when being programmed locally.

Auto On Data

This will cause the transmitter to be enabled (keyed) automatically on data received at the Serial Port and included in a complete frame for transmission over the radio channel. The maximum period for which the transmitter will be enabled is limited by the PTT timeout setting.

From Serial Port RTS

This will cause the transmitter to be enabled (keyed) on Serial Port RTS being asserted. The maximum period for which the transmitter will be enabled is limited by the PTT timeout setting. Applications which rely on establishing a link ahead of data being transferred require this method of activation.

PTT Timeout

The PTT timeout facility is used to disable the transmitter if it exceeds the designated time. The timeout value can range from 1 to 255 seconds and the facility is disabled by setting a zero value.

The timeout value chosen for this should be set according to system requirements which may include:
- Prevention of a remote unit remaining keyed up and locking out all other remote units in a point to multipoint system.
- Limiting the period a remote unit remains keyed up to prevent battery drain in a low power application.

Note: If a PTT timeout occurs before completion of a data transmission data will be lost.

Stream Setup

This button brings up a dialogue box with multiple tabs to allow you to configure your various ports SIDs. The Stream Identifier (SID) codes are used by the modem as an addressing mechanism for various types of data stream routing. A SID code is always placed at the start of each data frame as it is sent over the radio channel. The receiving modems use this SID to determine how to route the data message. The range in 0 - 255, serial ports must not use the same SIDs as Ethernet data.

Ethernet Port Stream Setup
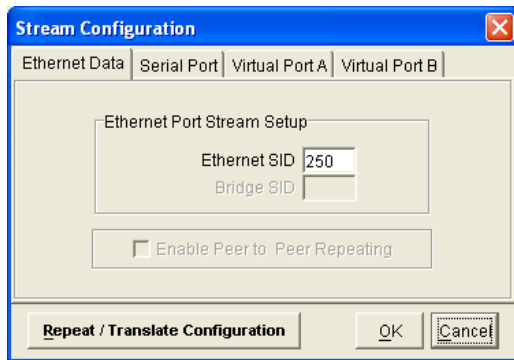
By default the Ethernet Stream Identifier Code (SID) is set to 250.

The SID numeric is appended onto the front of each Ethernet packet sent over the air. This allows receivers to filter wanted messages apart from unwanted messages.

When a unit is in Bridge mode, the Bridge SID parameter will become accessible (Default Bridge SID is set to 251). This allows you to control the direction of data flow. (Bridge mode is a future release). The SID parameter should be configured to match your access point's SID (or upstream unit) and the Bridge SID parameter should be configured to match your remote's SID off that bridge or Downstream unit. (Bridge mode is a future release).

Peer to peer repeating is only available within an Access point. When Enabled, the Access point will repeat data that is received on the Ethernet SID, however, if the message recieved in addressed to a MAC address that is known to be connected to it's local LAN port, the message will instead be sent to the LAN port and will not be Transmitted over the air. This reduces the amount of congestion on the narrow band channel.

Serial Port Stream Setup
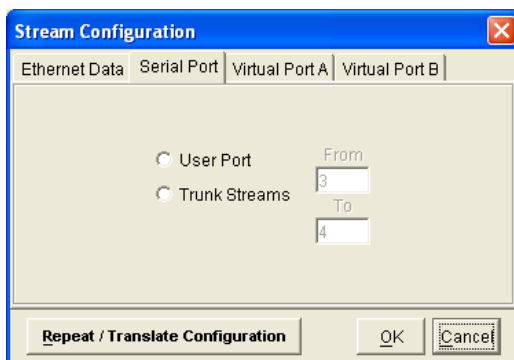
User Port

This option is selected by clicking on the User Port button and filling in the RxSID and TxSID fields to the right. The radio comes preconfigured with default values.

In User Port mode all SID code operations are performed transparently to the user data. Data placed into a user port which has been assigned a specified SID code, will only be received by a modem at the other end of the radio link that has a user port assigned with the same SID code. The SID code is added by the radio modem to the user data and removed by the radio modem before user data is outputted to the serial port.

Two SID codes values are available in user port mode RxSID and TxSID. The RxSID rule is applied to the data being received by the modem, and the TxSID is applied to the data being transmitted by the modem. This allows for different transmit and receive codes if required, but generally they would be both the same.

A situation where Tx and Rx SID codes may be different is in a repeater configuration. In this type of application all data sent to the repeater will be "repeated". Thus by having different Tx and Rx codes, a control unit will not "hear" its own transmission, and remotes will not hear the reply from any other remote. For more information please consult the Trio E Series training material available as a slide show from our website, www.triodatacom.com

The diagnostics facility also uses SID codes. The diagnostics data simply uses a different data stream to the user data, but is processed internally by the modem. If access to the diagnostics facility is required, the data port concerned, must have the same SID codes assigned to them, default is 0,0. Alternatively the System port can be used, which is 19.2K, Slip and has TxSID and RxSID 0,0 fixed

Trunk Streams

In the Trunk Streams mode, data that is inputted into the modem for transmission must already have a SID code appended to the start of the data packet. This mode requires the use of a "SLIP" interface as configured using the packet layer.

Trunk Steam mode is normally used in conjunction with Trio Diagnostics software, when connection to a MSR Stream Router or when connecting radios together such as a back-to-back connections as used in multiple point to point links.

In Trunk Stream mode a range of SID codes can be transmitted and received via a data port. The range is specified when this mode is selected. In a typical application, such as a back to back connection as used in a multiple point to point links, where all data (including diagnostics) from one radio needs to be "trunked" through to the other radio, the range used is 0 to 255.

Repeat/Translate Configuration

The modem is capable of operating in a repeater mode. One Repeat Range is available to be configured, however, if a second repeat range is required, the user port must be disabled. Data received from the radio channel with an appended SID that falls between the unit's repeat range/s is passed directly to the transmitter, and placed back onto the radio channel.

The repeater must receive a complete frame of data before it is retransmitted. In some systems this store and forward delay

may be significant, and careful selection of maximum frame sizes configured at the source unit must be considered to minimise the delay.

To enable the mode select "Repeat Range" in the Type field and specify the range of SID codes for which will be repeated.

Maximum of 2 repeat ranges can be used, ensure there is no overlap of SID ranges.

Translate Streams

This function is similar to repeat streams however it also translates the SID code from one value to another as the repeating function occurs.

This mode can be used to controlled data repeating in systems where more than one repeater is required, such as store and forward system or pipe-lines. If translate is not used then a 'Ping Pong' effect would occur between to adjacent sites.

Maximum of 16 translates can be used. Do not translate from the same SID more than once.

Diagnostics Setup

Polled Diagnostics

The Diagnostics Processor can be configured to listen for diagnostics on a range of SID codes. The factory default is SID code 0 (From Stream 0 To Stream 0). The diagnostics responses are sent back over the same stream as the questions.

Diagnostics Repeat

This option can be toggled on and off by clicking the button. Some applications will require that a repeater unit in a point to multipoint system repeats diagnostics frames only.

This will be the case when the system diagnostics controller is connected to a remote unit in the system, and it polls the system population from this point. The master unit must retransmit any diagnostic frames that are not addressed to itself onto the remainder of the population.

Automatic Diagnostic Reports

This option allows the configuration of automatic diagnostics. This option automatically appends diagnostics messages when user data is transmitted. This option can be toggled on and off by clicking the "Enable" button.

Minimum Report Interval : Specifies the amount of time before a diagnostics message is appended to the next user data message.Default setting is 3600 seconds.

Diagnostic Stream: Specifies the SID code used for the automatic diagnostics message. Default setting is 0

Controller Destination Address: Specifies the address of the Diagnostics Controller Software that is receiving the automatic messages and displaying them. This value must match that specified in the TView diagnostics software configuration. Range is 1 - 999. Default setting

eDiags Port Settings

eDiags can be enabled here via the Enabled check box. enabling eDiags in a radio will allow it to act as an ethernet entry point for Diagnostics. only radio that are going to be used as an eDiags entry should have this featur enabled. The entry point radio must know have it local port configured to allow Diagnostics to send UDP messages to it.

- Local IP Port: This defines the radios local IP port that it will b listening on. this information is required when setting up diagnostics.

- Controller IP Address: This parameter is the IP address of the Computer running eDiags. This is required so that the radio knows where to send eDiags messages.

- Controller IP Port: This Parameter is the Port number eDiags is using. This is required so that the radio knows where to send eDiags messages.

Virtual Terminal Server
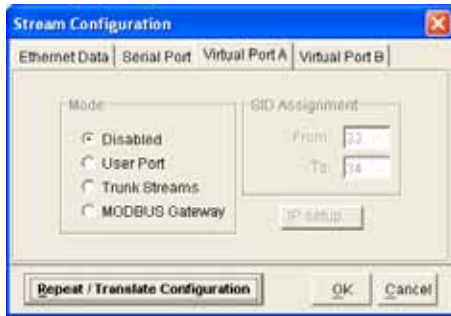
The virtual ports are designed to minimise the over the air bandwidth requirements by converting either IP encapsulated serial data into raw serial data or IP MODBUS TCP/UDP into MODBUS RTU. The result is that serial data can be carried over the RF channel much more efficiently than IP encapsulated serial data or IP MODBUS TCP/UDP, which contains additional IP and Ethernet MAC overhead for each packet transmitted.

The Virtual ports replace a need for an external terminal server or MODBUS gateway to be placed between the IP connection (from the cloud) and the serial port of the entry point radio. For an example for virtual terminal servers or MODBUS gateways, please refer to Part D.

Disabled:
This check box will disable the virtual port when selected.

User Port:
This check box will enable the virtual port as a terminal server in user port mode, this means that any serial data sent over the air from this unit, will have Trio's SID addressing appended to it. for detailed information on SID addressing please see Part G - User port.

Trunk Streams:
This check box will enable the virtual port as a terminal server in trunk mode, this means that any serial data sent over the air from this unit, will be trunked using Trio's SID addressing mechanism. for further information on SID addressing please see Part G Trunk Streams.

Modbus Gateway:
This check box will enable the virtual port as a MODBUS gateway, this means that any IP MODBUS TCP/UDP message that comes in on the Modbus gateway's port, will be converted to MODBUS RTU (Serial) and transmitted over the air.

IP Setup:
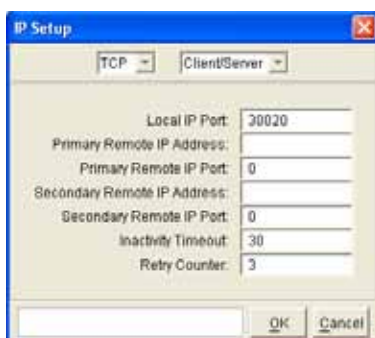The IP Setup button will allow you to configure the virtual port as if it were a basic terminal server or Modbus gateway. The first drop down box gives the option between two different Layer 2 protcols: TCP or UDP. When selected, each of these protocols will reveal different configuration parameters.

TCP:

When TCP is selected, the options of Client, Server or Client/Server will appear. Each option must be correctly defined in order for the device to behave in the desired manner.

Client:
Selecting Client will cause the device to interact with a TCP server that is locally conected to the LAN port. The client must be configured to know what the IP address and port number the Server uses to establish a session. These parameters must be defined in the bottom half of the IP Setup window. When data is received from the server, the client will then strip all ethernet headers from the data and pass the serial data only to the user port for SID appending.

- Primary Remote IP Address: This parameter defines the primary destination IP address of a TCP encapsulated packet.

- Primary Remote IP Port: This parameter defines the port number that the device who owns the Primary IP address is listening on. The port range is 1 to 49151.

- Secondary Remote IP Address: This parameter defines the secondary or 'alternate' IP address that TCP messages will be sent to when the Primary IP address becomes unavailable. If there is no secondary IP address in your system, this paramter may be left blank.

- Secondary Remote IP Port: This Parameter defines the Port number of the Secondary IP address. The port range is 1 to 49151.

- Inactivity Timeout: The inactivity timeout parameter will start counting down when there has been no user data being past between the client and server. The timeout range is 1 to 10000.

- Retry Count: This parameter defines how many retrys to establish a new TCP connection with a server. The retry range is 0 to 255.

- MODBUS RTU timeout: This parameter defines the period of time the radio will for a response bofore delcaring a sent message lost. The MODBUS RTU timeout range is 1 to 256 seconds. (MODBUS gateway mode only).

Server:
Selecting Server will cause the device to interact with a TCP client that is locally conected to the LAN port. The Server must be configured to know what port number to listen on to be able to establish a session. The TCP server can establish upto 4 different TCP connection at one time with different servers. If a client device establishes a connection and does not end the session, this can cease the available connections. An inactivity timeout time must be defined, so as to prevent this from occuring. These parameters must be defined in the bottom half of the IP Setup window. When data is received from the client, the server will then strip all ethernet headers from the port and pass the serial data only to the user port for SID appending.

- Local IP Port: This will define the IP port the device is required to listen on to receive messages. The local port range is 1 to 49151.

- Inactivity Timeout: The inactivity timeout parameter will start counting down when there has been no user data being past between the client and server. The timeout range is 1 to 10000.

Client/Server:

Selecting Client/Server will configure a device to act as both a client and a server as described previously.

UDP:
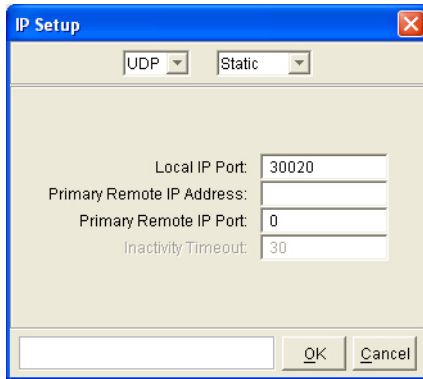
Once UDP is selected, the option between Static or Dynamic will appear.

Static:

A static UDP connection must know what Port to listen on and what IP address and IP port to send data to. These parameters are defined in the bottom half of the IP Setup window.

- Local IP Port: This will define the IP port the device is required to listen on to receive messages.

- Primary Remote IP Address: This parameter defines the primary destination IP address of a UDP packet.

- Primary Remote IP Port: This parameter defines the port number that the device who owns the Primary IP address is listening on.

Dynamic:

A dynamic UDP connection does not need to know the destination IP address or port number of any one device. Any message that is received by the dynamic device will have the IP address of the sending device embedded into it, this allows the dynamic device to know who to send the message back to.

- Local IP Port: This will define the IP port the dynamic device is required to listen on to receive messages.

- Inactivity Time Out: The device device will discard a TCP session between it's self and a client, once the time out time has reached zero. This is from the last message received from the client.

SID Routing Mode & SID Assignment:

Once the Virtual port has received TCP/UDP serial encapsulated frames via the LAN port, the frames will be down to raw serial data. The serial data is then passed to the virtual user port, the user port will handle the data differently depending on whther it is configured as a user port or a trunk port. For detailed information regarding user ports and trunk streams please see part G - Serial Port setup. When serial data is received from over the air and the SID codes match the virtual port, the serial data is encapsulated within ethernet by the virtual port and sent out of the LAN port.

Collision Avoidance
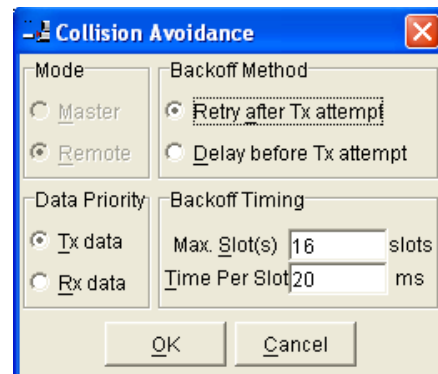
In a point to multipoint system the master unit (usually a base station) can transmit at any time and the remotes will all receive the broadcast signal. However, if more than one remote unit transmits at a time, then a collision will occur during the multiple transmissions, resulting in a loss of data from one or more units.

Two collision avoidance mechanisms have been included in the modem. The standard (Digital) method utilises a signalling channel which is embedded in overhead data transmitted over the radio channel. The second method utilises detection of a carrier signal to postpone transmission of data. Both methods require configuration of several options for successful operation.

The desired option for collision avoidance is selected by checking the control button to the left of the description on the main window.

None

When selected this turns off all collision avoidance mechanisms. This should only be used in point to point applications.

Digital

This is the standard method of collision avoidance and utilises a channel busy indication bit in the signalling channel transmitted to all remotes for control. When selected a dialogue box appears and several options must be configured:

Note: Digital collision avoidance requires the collision avoidance master to be permanently transmitting to inform remote when the channel is available. If the master is not transmiting this information, remotse will not be allowed to transmit at all.

- Mode – "Master" or "Remote". When the master unit receives a valid transmission from a remote unit it sets the channel busy indication bit. This busy bit is interpreted by the other remotes to not transmit. Once the transmission from the first remote ends the master unit resets the busy bit to indicate the channel is now clear to transmit on. The master unit, which is normally a base station, takes about 5ms to detect a transmission from a remote unit and set the channel busy indication bit on the radio channel. During this period collision of remote transmissions can still occur and is unavoidable.
  Note: The master must be permanently keyed.

- Backoff Method – "Retry after Tx Attempt" or "Delay before Tx Attempt". The method chosen is system dependent and can only be configured if the mode is "remote". The former is best used when data responses from remotes are largely asynchronous. The latter is best used when this is not the case.

- Backoff Timing – "Maximum Slots", "Time per Slot". This can only be configured if the mode is "remote". When a remote is ready to transmit data but it finds the busy bit from the master set it holds back its transmission for a random "backoff" time after which it tries to transmit data again. This ensures that modems waiting to be allowed to transmit do not re-attempt to do so at the same time. The "Maximum Slots" (1 to 16) and the "Time per Slot" (1 to 255ms) are used to calculate the backoff time by multiplying the slot time by a random number between 1 and the maximum slot number. For example if the time per slot is 30ms and the maximum slots is 4, the random backoff times can be 30, 60, 90 or 120ms.

Data Priority

Tx Data 'Priority': Tx Prioroity only observes the digital collision avoidance masters channel busy flag. This flag is only set active when the collision avoidance master is receiving data from a remote. If the collision avoidance master is transmitting data, the channel busy flag is not set and remote units will transmit over the top of incomming data. As the remotes are typically half duplex, the remote will not be capable of receiving and transmitting data simotaniously. Essentially this mode waits for the channel busy bit to be clear then it will send any data it needs to.

Rx Data 'Priority': As well as observing the channel busy flag rules, the remote radio also prevents it's transmissions from energizing if it is receiving data from the master. Once the incoming data is complete and the busy flag is checked and is off then a response from this remote will be transmitted.

As the channel busy indication bit is critical for reliable operation default interpretation of this bit is defined in the remote units. If the master modem stops transmission (or has not yet started) the remote will interpret that the channel is busy and will not transmit until the master comes on line.

Carrier Detect

This method of collision avoidance utilises a carrier transmitted to all remotes to indicate that the radio channel is busy. When selected a dialogue box appears and several options must be configured:

- Mode – "Master" or "Remote". When the master unit receives a valid transmission from a remote unit it transmits a carrier signal to indicate busy. Of course the master will also initiate a transmission if it has data to send. The transmitted carrier is interpreted by the other remotes to not transmit. Once the transmission from the first remote ends the master unit stops transmission to indicate the channel is now clear to transmit on. The master unit, which is normally a base station, takes about 5ms to detect a transmission from a remote unit and transmit a carrier signal. During this period collision of remote transmissions can still occur and is unavoidable.

- Note: The master can only be a full duplex unit and cannot be permanently transmitting. For half duplex and simplex systems all units should be set as "Remote" (no Master).

- Backoff Timing – "Maximum Slots", "Time per Slot". This can only be configured if the mode is "remote". When a remote is ready to transmit data but it detects a carrier signal from the master set it holds back its transmission for a random "backoff" time after which it tries to transmit data again. This ensures that modems waiting to be allowed to transmit do not re-attempt to do so at the same time. The "Maximum Slots" (1 to 16) and the "Time per Slot" (1 to 255ms) are used to calculate the backoff time by multiplying the slot time by a random number between 1 and the maximum slot number. For example if the time per slot is 30ms and the maximum slots is 4, the random backoff times can be 30, 60, 90 or 120ms.

Unit Information

The information displayed is intended to assist the user to identify the radio modem as well as support should their services be needed.

Model Type refers to the type of unit. The ER45e is a remote unit and the EE45e is a exciter inside a Ethernet base station unit. Gen III will be noted where Gen III hardware is detected.

Freq Band & Bandwidth refers to the frequency band supported by the radio as well as the channel bandwidth. For example 51A02 is a type 51 band with a 25kHz channel.

Serial Number is unique to each unit and is set within the unit at time of production as well as included on the label fixed to the unit.

Firmware Pack refers to the firmware package version installed in the radio. There are several components associated with microcontroller and DSP firmware installed and a single version number is used to identify them.

Diags Installed is set to yes or no depending on whether the diagnostics key has been set in the unit.

Unit Information (Details)
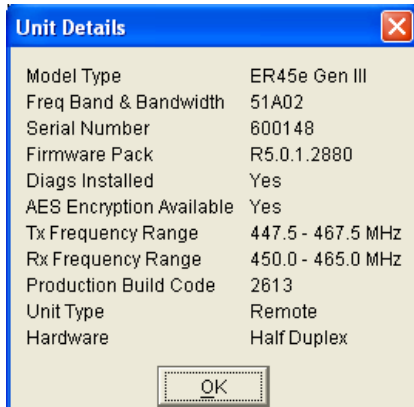
More detailed information is also available to assist in identifying components installed in the unit (remote, base station or hot standby).

The additional information provided is:

- Controller Rev refers to the microcontroller firmware component version for the radio.

- DSP Code Rev refers to the DSP firmware component version for the radio.

- Processor Board ID refers to the processor board identification number and hardware revision information for the radio.

- RF Deck ID refers to the RF deck board identification number and hardware revision information inside the radio.

- Production Build Code refers to the automated production test and calibration sequence used during manufacture of the radio.

- Hardware indicates whether the radio is half or full duplex.

- Unit Type indicates whether the unit is recognised as a remote or base station.

- Tx and RX Frequency Range indicates the frequency range for which the radio is capable of being operated in.

In the case of a base station unit the following additional information is provided:

- Base Firmware Pack refers to the firmware package version installed in the base station (front panel) controller which is separate to the radio installed. There are several components associated with this firmware package and a single version number is used to identify them.

- Base Controller Rev refers to the microcontroller firmware component version for the base station.

Radio Mode (Ethernet)

There are two different Ethernet modes you can configure your radio to be. (Bridge mode is a future release).

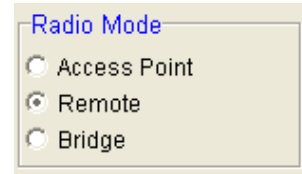Access Point - Defines the Access Point in a Network. The function of the access point is to manage remotes beneath it. There must be one and only one Access point per Radio network.

Remote - A remote radio in the network. The function of a remote is to communicate with the Access Point directly.

Security
Within the Security menu you will notice you have three available tabs to select from.

Please note that all parameters within the security menu are NOT saved within a saved configuration. Security features can only be written in a live programming session.

SNMP

Within this tab you will notice 3 selectable options:

- Disabled - This will Disable the SNMP functionality of the radio.

- SNMP V1 - will enable the Radio to use SNMP V1 RFC1213

- SNMP V2 - will enable the Radio to use SNMP V2 RFC1213.

Whenever you enable SNMP V1 or V2 you are required to enter two community strings. The community strings define the relationship between an SNMP server system and the client systems. This strings acts like a password to control the clients' access to the server.

- Read community string - allows Read only access to the unit's SNMP data.

- Write community string - allows write only access to the unit.

Encryption (option upon purchase)

Within this tab you will notice two options:

- Disabled - This option will disable the radios encryption capability.

- Enabled - This option will enable the radios encryption capability. Once selected, you will be required to enter an alpha-numeric or hexadecimal string

Encryption Setup

128 bit AES Encryption can be enabled in the radio. Radios that have 128-bit AES encryption enabled can only communicate with other radios that have AES encryption enabled and use the same encryption key.

AES Encryption is enabled by selecting the Enabled button and entering an "Encryption key". The "Encryption key" must be between 8 and 16 characters long. The key can contain ASCII or hexadecimal characters. When entering hexadecimal characters, the format must be "0xDD" where DD is a sequence of hexadecimal digits. (0-9,A-F).

When a radio configuration is read from a radio that already has AES encryption enabled, the encryption key will be shown as "**************" in the programmer to indicated encryption is enabled. Since there is no mechanism to see the encryption in plain text you must ensure the encryption key is recorded in a safe and secure place for future reference.

Note : When AES encryption is enabled in the radio, the Serial Port packet layer settings may be modified to ensure compatibility with AES encryption mode.

Note : AES encryption is subject to export restrictions and may not be available in all countries.

Password
The Password tab is used to give your units configuration protection. You will notice you have two options:

- Disabled - This allows the radios configuration can be read/written to without a password.

- Enabled - This prompts the user for a password upon starting a programming session. To set the Password, write an alpha numeric string of no longer than 16 characters long into to the Password box, then write the same string into the confirm password box beneath it.

Messages

The message window provides a log of error messages occurring during use of the programmer utility. Several error messages may occur as a result of an inappropriate selection.

Status Bar

The status bar is located at the bottom of the main window and provides information regarding communication actions occurring with the radio data modem.

Additional fields located on the status bar include:

- Unit ID refers to the identification label used by the diagnostics utility. This is currently the same as the unit's serial number.

- Mode refers to the type of session established. It can be a File, Local indicating a local port connection to the unit or Remote indicating communications is via a radio channel.

Part I – Appendices

Appendix A - Firmware Updates

Firmware updates on an Ethernet E-Series radio can be perfomred in two different ways: Locally connected and remotely connected (over the air). Appendix A will describe how to perform both methods.

Locally connected Remote and Exciter Firmware update Overview

It is recommended that all cabling to the unit be disconnected prior to commencing firmware update to minimise any interruption to the process or disturbances of signals on cables still connected. All other TView+ Management Suite utilities should also be exited during the firmware update process.

Please down load the Latest Firmware Pack from the Trio website At: http://www.triodatacom.com/scada_supp.php

Firmware Update Method for Radios Serial No: 600000 or above.

To perform a Local Firmware update on an E series Ethernet Radio you must follow the following instruction to establish a connection to it's embedded HTML Web server.

IP Address and Factory default Reset

The IP address of the radio can be read using the TView+ Programmer. If you can not read the unit's IP address then you can factory default the radio. The factory default IP address of the ER45e is 192.168.2.15. A factory default reset will cause all previous configuration setting to be erased and returned to the factory default values.

A factory default on a remote can be initiated by applying DC power to the radio (wait 45 seconds), depress the factory default switch by using a paper clip or a similar object and keep the switch depressed for 5 seconds until all 4 LEDs illuminate solid GREEN indicating the radio will return to the factory defaults settings. Please wait 30 seconds for the factory default reset process to complete.

A factory default on a Base station can be initiated by applying DC power to the radio (wait 45 seconds). Then depress the Display ON/OFF switch until the Display LEDs begin to flash (Approx 15 seconds), then release the button for at least 1 second, then depress it again until the front LED indicators stop flashing (Approx 15 seconds).

Connection to Embedded HTML Server

The ER45e Radio contains an embedded Web Server. To Perform a Firmware upgrade in the ER45e, you will need to connect your PC to the LAN port of your radio, and direct your browser to the IP address of the locally connected unit. It is strongly recommended that you follow these guidelines for successful connection to the radio.

1) Ensure the ER45e is powered and has fully booted. This is indicated by a solid green power LED. It takes about 45 seconds for the radio to fully power up.

2) Disconnect you PC from any other internet/LAN networks. Failure to do so may create a conflict in IP addresses or the ER45e might not meet the subnet mask specified by you network.

3) Connect your PC Ethernet Port to the units LAN Port using an RJ-45 Patch Cable. Cross over cables will also work. Successful cable connection is indicated be a solid Green "Link LED on the LAN port.

Note: The LAN port will also flash amber when data is being transferred.

4) Ensure your PC LAN Port is configured for a suitable IP address. You can do this by configuring the LAN settings via the control panel. Navigate to your Windows "Start" button and open Control Panel -> Network Connections -> Local Area Connection -> Properties. Scroll down and select "Internet Protocol (TCP/IP) and the click on Properties. You will now see the window as shown. Ensure "Obtain IP Address Automatically" is NOT selected. It is recommended that you manually specify a compatible IP Address. In this example, a factory default radio is being Firmware upgraded. The IP address of the radio is 192.168.2.15 and a compatible IP address for the PC would be 192.168.2.1. Click OK to accept the changes.

Note: Check with your Network Administrator before allocating IP addresses as each LAN/WAN network is different.

5) You should start your web browser and insert the IP address of the ER45e into the URL. In this case, we type "192.168.2.15" and the configuration page is now displayed in the browser.

Note: You may need to disable a web proxy (if in use) or disable or modify your local firewall to ensure security rules allow access to the ER45e's IP address.
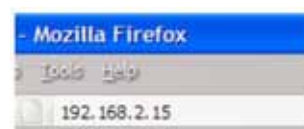
Performing a Firmware Update

Once you have entered the Radios embedded HTML home page. Up the top of the page there are some buttons, select the Maintenance.

Allow a few moments for the Firmware Update page to load. Once the page has loaded, you should be able to

see two headings, "Firmware" and "Upload Firmware Pack". Underneath the Firmware heading you will be able to see;

Your current firmware version and your alternate firmware version (your radio may not have one).

Firmware

Current Firmware:

Alternate Firmware:

Underneath you Upload Firmware Pack heading, you will be able to see

"Select TPK File" and a Browse Button.

Upload Firmware Pack

Select TPK File: Browse..

Click on the Browse button and Select the Firmware TPK file you have downloaded from the Trio Datacom Website (www.triodatacom.com) that you wish to upgrade to. Once selected press the "Upload Firmware" button that is to the right of the browse button.
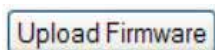
Upload Firmware

Wait until the Firmware Pack has uploaded. Once the Firmware pack has uploaded successfully, you will notice that it now appears in the 'Alternate Firmware' section. Click the "Activate Alternate" button to the right side the Alternate Firmware section.

Activate Alternate
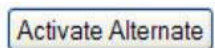
Once successfully activated you will notice that the Firmware pack you have upgraded to will now be under the "Current Firmware" section.

Base Station Display Firmware Update

Note: Base Station Display Firmware Updates can only be performed Locally.

Installation Instructions:

1. Update of the front panel firmware uses the firmware update utility supplied with the TView+ Management Suite.

2. Start the firmware update utility from the TView+ front panel.

3. In the firmware update utility select device type as "Base Station Front Panel"

4. Select the file containing the firmware update package using the "Open Firmware Package" button at the bottom of the main window. After opening the file the browse window will close and a description of the firmware package will appear in the main window.

5. Ensure that the base station is powered.

6. Connect the "TView+ cable" to the front or rear system port of the base station.

7. On the base station front panel depress and hold the "Display On/Off" button, then momentarily depress the firmware update switch using a suitable probe before releasing the "Display On/Off" button. The firmware update switch is located behind the small hole (not labelled) in the front panel below the "Display On/Off" button.

Note: Display Status LEDs will be lit in this Mode.

8. Initiate the firmware update process using the "Write" button at the bottom of the main window. Another logging window will appear.

9. The logging window will display the progress of each firmware block transferred and when complete a success dialogue box appears. Click OK to close this dialogue box and click "Exit" in the main window to exit the firmware update utility.

Note: If a mismatch occurs between selected file and device type, an error message will appear.

10. Re power the base station to enable the new firmware.

Hot Standby Controller Firmware Update

Note: Hot Standby Controller Firmware Updates can only be performed Locally.

Installation Instructions:

1. Update of the hot standby firmware uses the firmware update utility supplied with the TView+ Management Suite.

2. Start the firmware update utility from the TView+ front panel.

3. In the firmware update utility select device type as "Hot Standby Controller".

4. Select the file containing the firmware update package using the "Open Firmware Package" button at the bottom of the main window. After opening the file the browse window will close and a description of the firmware package will appear in the main window.
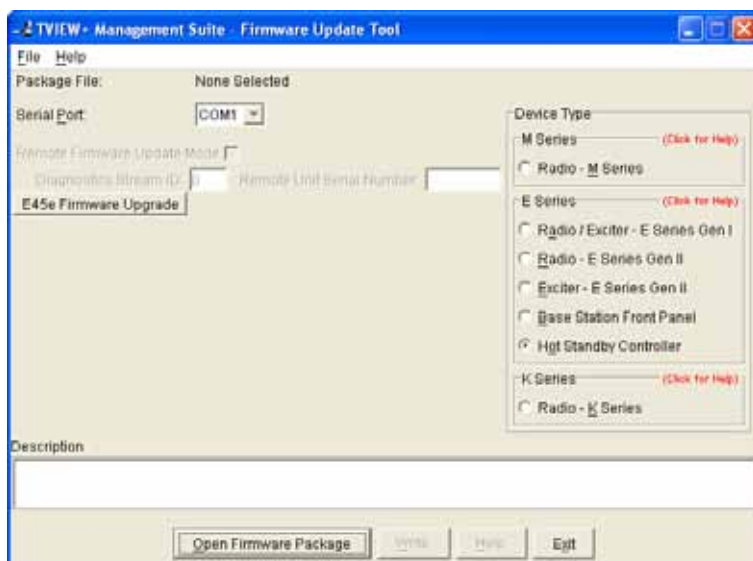
5. Ensure that the hot standby controller is powered.

6. Connect the "TView+ cable" to the front or rear system port of the hot standby controller. .

7. On the hot standby controller front panel, depress and hold the "Reset Alarms" button, then momentarily depress the firmware update switch using a suitable thin probe. Now release the "Reset Alarms" button. The two LEDs either side of the "Select" switch should turn green indicating the hot standby controller is in firmware updating mode.

Note : The firmware update switch is located behind the small hole (not labelled) in the front panel to left of "Reset Alarm" button.

8. Initiate the firmware update process using the "Write" button at the bottom of the main window. Another logging window will appear.

9. The logging window will display the progress of each firmware block transferred and when complete a success dialogue box appears. Click OK to close this dialogue box and click "Exit" in the main window to exit the firmware update utility.

Note: If a mismatch occurs between selected file and device type, an error message will appear.

10. Repower the hot standby controller to enable the new firmware.

Global Firmware Update Facility

Introduction

The TView+ Programming software provides a facility to perform Global firmware updates to every Ethernet E Series radio within a network over the RF channel. The Global firmware update facility uses two techniques to limit the impact on user data.

1. Data rate limiting which trickles the data onto the RF channel at 5% of the channel capacity.

2. Differential firmware packs dramatically reduce the size of the file needed to be sent over the RF channel.

The combination of these two features allows seamless operation of SCADA traffic while the update is in progress.

If every radio is being upgraded from the same version of firmware, the upgrade will take approximately 8 hours to complete at an RF speed of 9600bps.

Minimum Programmer Requirements

TView+ Programming software Version 3.19.1 (Build 44) onwards

Connection

Ethernet cable between the PC and the LAN port of the entry point radio.

Early Firmware version Instructions

Check the Version of Firmware in the target unit to be upgraded. If it is Version 5.0.3 Rev 3056 or earlier please refer to the Legacy Radio Firmware Upgrade Patch instructions at the end of the Global Firmware update instructions before proceeding any further.

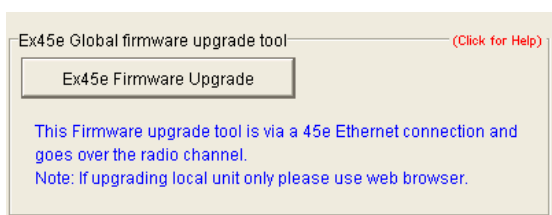### Configuration requirements - Radios

SNMP is the transport protocol utilized by the firmware update process. Before remote firmware updating can occur, SNMP must be enabled (V1 or V2c but must all be the same) within all of the target Ethernet E-Series radios and have the read/write Community string set to the same password, this password will be later entered in the firmware upgrade window of TView. Note when setting up SNMP in the radios the read and read/write community strings must be different otherwise SNMP writes will not work.

The firmware upgrade tool sends the firmware update messages to the networks broadcast address. The broadcast address of any Ethernet device is calculated from the units IP address and Subnet Mask. This means that the subnet mask in the following items must all match exactly the same:

- Each radio within the network being firmware upgraded
- The PC that is performing the global firmware upgrade
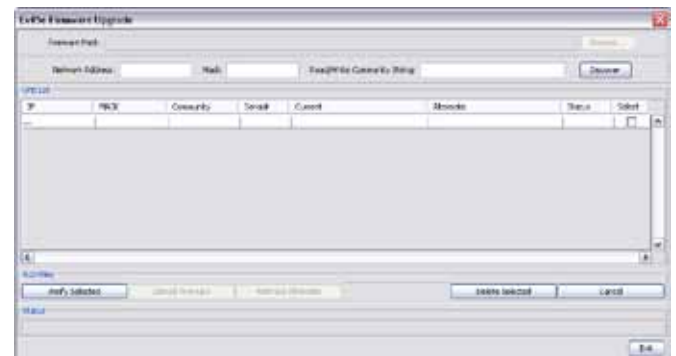- The global firmware upgrade tool

Configuration requirements - Firmware update tool

Open TView+ Programming suite and select the Firmware update button.

Ex45e Global firmware upgrade tool   (Click for Help)

Ex45e Firmware Upgrade

This Firmware upgrade tool is via a 45e Ethernet connection and goes over the radio channel.
Note: If upgrading local unit only please use web browser.

Select the "E45e Firmware Update" Button.

Once selected, the global firmware update tool will appear.

Network Address:

This parameter defines the IP Address of the network. Otherwise known as Subnet IP, Base Address or Subnet ID (This is not the same as the Subnet ID found within the K/J series radios).

Mask:

The mask to be applied to define the Subnet. Otherwise known as Netmask. The Mask must match the Subnet mask set within all of the target radios as well as that of the PC.

Note: For information on how to determine what your network address and subnet mask is, please see your network specialist or refer to a network calculator such as the one found at this address: (http://ipcalc.nmonitoring.com/).

- Example: If your radio IP addresses are all in the range 192.168.1.1 to 192.168.1.254 and your subnet mask is 255.255.255.0 then the Network Address is 192.168.2.0. If your system is more complex than this please refer to "http://ipcalc.nmonitoring.com/".

Read/Write Community String:

The Read/Write Community String must match that set within all of the target radios. (Unless following patch instructions)

Discover Button (Auto):

If you do not wish to search through your entire subnet range, a manual entry can be used instead of the auto discover button. if you wish to use the manual entry system please skip this step and see 'Discover (Manual entry)'.

Once the Network Address, Mask & Read/Write Community String Parameters have been filled correctly, the "Discover" Button may be selected. The Status bar at the bottom of the window will begin searching for any unit that falls within the subnet Mask. Any units that are discovered will be populated within the Unit List window.

Discover (Manual entry):

If you know all of the IP addresses, masks and read/write community strings of the units you wish to firmware upgrade in your network, a manual entry can be made instead of selecting the Discover button. Within the Unit List simply click inside the white blank box underneath 'IP' and fill in your units IP address, once completed press enter, you will notice a new row appear for an additional unit if required, this will continue to happen after every IP address added to the list. Now fill in your units MASK and Community string.

Verify Selected Button:

Once the units have either been discovered automatically or have been manually entered, ensure that the units that require firmware upgrading are checked in the 'Select' column. Once the units are selected, click the "Verify Selected" button. This will verify that each of the selected units will respond again. If the units were manually entered, the verification will also pull in the current and alternate firmware packs for each selected unit.

Once the verification is complete, you must select the firmware you want to load into the radios. To do this, you can click the 'Browse...' button to select a Firmware pack. Current firmware packages can be downloaded form the Trio website (www.triodatacom.com). Select the global Firmware Zip package (Firmware-Patch-ER45e-Rx.x.x-xxxx.zip). This zip package contains multiple patch files. The global firmware update tool will select the correct patch file within the zip file for each radio within the un to be sent to the selected radios by selecting the 'Browse' button at the top of the page. Please ensure the selected radios are not running Firmware version 5.0.3 Rev 3056 or earlier. If they are please refer to the Client Patch instructions if not done already.

Once the Firmware Pack is selected the upload may commence. This is done by Selecting the 'Upload Firmware' button. This process will take some time.

After the Upload process is complete, the new Firmware will be loaded into each radios alternate firmware pack waiting for activation, to active the new firmware click the 'Activate Alternate' button.

Delete Selested Button:

The 'Delete Selected' button allows the user to remove unwanted discovered or verified units from the Unit List.

Legacy Radio Firmware Upgrade Patch

If a target radio is running Firmware version **5.0.3 Rev 3056** or earlier, a client patch file must be loaded into the units alternate firmware pack location before a global firmware update is performed, do not try to activate the Client Patch file. The Client Patch file can be remotely or locally loaded via a unit's web browser. The Client Patch file is not a large file (approx 100K) but web browsing to a remote unit uses a large amount of bandwidth. The most up to date Client Patch file is available from the Trio website (www.triodatacom.com) and will have naming convention: FW-UpgradeClientPatch-ER45e-Rx.x.x-xxxx.tpk

If the Client Patch file has been loaded correctly into a unit, the global firmware update tool will display the patch file in the alternate firmware pack position as shown below when the unit is discovered.
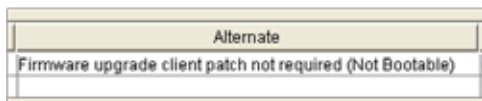
Once the Client Patch has been successfully loaded into the units alternate firmware pack, please proceed with the Global Firmware upgrade instructions

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